UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

OCT 27 2003

In *Reply* Refer To:
SWR-02-SA-6433:JSS

Nancy A. Haley
Chief, San Joaquin Valley Office
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Ms. Haley:

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion based on our review of the proposed South Delta Diversions Dredging and Modification project in the counties of Alameda, Contra Costa and San Joaquin, California, and its effects on endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha),* threatened Central Valley spring-run Chinook salmon *(O. tshawytscha),* and threatened Central Valley Steelhead *(O. mykiss)* in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your June 19, 2002, request for formal consultation was received on June 20, 2002.

This biological opinion (Enclosure 1) is based on information provided from an October 18, 2001, project proposal meeting attended by staff from the U.S. Army Corps of Engineers (Corps), California Department of Fish and Game (DFG), California Department of Water Resources (DWR), U.S. Fish and Wildlife Service (FWS), and NOAA Fisheries; the April 18, 2002, Proposed Mitigated Negative Declaration and Initial Study; the June 20, 2002, section 7 consultation initiation package; telephone conversations held August 14 and 16, 2002, between staff from NOAA Fisheries and staff from DWR and DFG, regarding project alternatives and agency concerns; and the DFG 1601 streambed alteration agreement (dated August 15, 2002) for the proposed project. A complete administrative record of this consultation is on file at the Sacramento Area Office of NOAA Fisheries.

The biological opinion concludes that the South Delta Diversions Dredging and Modification Project proposed by DWR and permitted by the Corps is not likely to jeopardize the continued existence of the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead. NOAA Fisheries believes that there will be some incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead as a result of the project's implementation.

However, because NOAA cannot predict which diversions are likely to be addressed under this program, the programmatic incidental take statement included with the biological opinion describes the maximum amount of incidental take that could occur, but does not exempt the incidental take until such time as project-specific details are reviewed by NOAA Fisheries as described in this opinion. This statement also contains reasonable and prudent measures that NOAA Fisheries believes are necessary and appropriate to reduce, minimize, and monitor project impacts. Terms and conditions to implement the reasonable and prudent measures are presented in the take statement and must be adhered to in order for the take exemptions of section 7(o)(2) of the ESA to apply (16 U.S.C. 1536(o)(2)). These conditions would apply to projects receiving take exemptions as described in the opinion. This biological opinion expires five years after the issuance of this document, or after the expiration of the Corps' five-year Regional General Permit (RGP) covering the project, which ever occurs later.

The biological opinion also provides conservation recommendations for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead. These include studies designed to explore migration and habitat utilization by salmonids in the South Delta, activities to restore and maintain Delta riparian and aquatic habitat, and the development of agricultural practices that avoid or minimize deleterious effects on salmonids.

This document also transmits NOAA Fisheries' Essential Fish Habitat (EFH) Conservation Recommendations for Pacific salmon (*Oncorhynchus spp*) as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). The Corps has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed response in writing to NOAA Fisheries within 30 days of receipt of these Conservation Recommendations that includes a description of the measures proposed for avoiding, mitigating, or offsetting the impact of the activity on EFH (50 CFR 600.920 [j]). If unable to complete a final response within 30 days, the Corps should provide an interim written response within 30 days before submitting its final response.

If you have any questions regarding this response, please contact Jeffrey Stuart in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Stuart may be reached by telephone at (916) 930-3607 or by Fax at (916) 930-3629.

Sincerely,

for Rodney R. McInnis
Acting Regional Administrator

Enclosures (2)

cc: Mark A. Holderman, P.E. Chief, Temporary Barriers Project and Lower San Joaquin Bay-Delta Office, California Department of Water Resources, 1416 9th St., P.O. Box 942836, Sacramento, CA 94236-0001

Ryan Olah, U.S. Fish and Wildlife Service, 2800 Cottage Way, Suite W-2605, Sacramento, California 95285-1846

Jim Starr, California Department of Fish And Game, Central Valley Bay Delta Branch, 4001 N. Wilson, Stockton, California 94205

Enclosure 1

BIOLOGICAL OPINION

Agency: U.S. Army Corps of Engineers, Sacramento District

Activity: South Delta Diversions Dredging and Modification Project

Consultation Conducted By: Southwest Region, National Marine Fisheries Service

Date Issued: OCT 27 2003

I. CONSULTATION HISTORY

The Sacramento District of the U.S. Army Corps of Engineers (Corps) has determined that a group of actions in the South Delta, which will provide maintenance dredging and minor modifications to existing agricultural water diversions, would be authorized under a five-year Regional General Permit (RGP), and has requested section 7 consultation with the National Marine Fisheries Service (NOAA Fisheries). Specifically, the consultation will evaluate the impacts of activities authorized by the RGP and identify measures to minimize or avoid adverse affects to endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha),* threatened Central Valley spring-run Chinook salmon *(O. tshawytscha),* and threatened Central Valley steelhead *(O. mykiss*). In order to simplify this process, NOAA Fisheries and the Corps have agreed to conduct a programmatic consultation on the RGP to allow for a more streamlined evaluation of the effects of individual activities as they are proposed.

The five-year RGP will authorize maintenance related activities in the southern portion of the Sacramento-San Joaquin Delta (South Delta) for agricultural diversions that have been negatively impacted by the operation of the temporary barriers project and the continued diversion of waters by the State Water Project (SWP) and the Federal Central Valley Project (CVP). Projects authorized under this permit include dredging around diversion intakes to remove built up sediments, minor alterations to diversion intakes, localized relocation of diversion intakes, and utilization of temporary pumps to replace or augment impacted diversions. The Corps has determined that some of these actions permitted by the RGP may adversely affect the listed salmonids in the region. This programmatic consultation evaluates the effects of the RGP based on the probable effects on listed salmonids and their habitat from activities associated with the maintenance activities.

On October 18, 2001, staff from the Corps, U.S. Fish and Wildlife Service (FWS), NOAA Fisheries, California Department of Water Resources (DWR), and California Department of Fish and Game (DFG) held an initial meeting to discuss the proposed project.

On April 18, 2002, NOAA Fisheries received an electronic copy of the draft Proposed Mitigated Negative Declaration and Initial Study for the proposed project.

On June 20, 2002, the Corps initiated formal consultation with NOAA Fisheries pursuant to section 7 of the Endangered Species Act (ESA) to determine whether the South Delta Diversions Dredging and Modification project would jeopardize the continued existence of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead.

On August 14 and 16, 2002, staff from DWR, DFG, and NOAA Fisheries discussed project alternatives and agency concerns via telephone. NOAA Fisheries requested a copy of the DFG 1601 streambed alteration agreement to supplement the initiation package.

On August 30, 2002, NOAA Fisheries received a copy of the DFG 1601 streambed alteration agreement (dated August 15, 2002) for the proposed project.

This biological opinion is based on information provided from an October 18, 2001, project proposal meeting attended by staff from the Corps, DFG, DWR, FWS, and NOAA Fisheries; the April 18, 2002, Proposed Mitigated Negative Declaration and Initial Study (DWR 2002); the June 20, 2002, section 7 consultation initiation package; telephone conversations held August 14 and 16, 2002, between staff from NOAA Fisheries and staff from DWR and DFG, regarding project alternatives and agency concerns; and the DFG 1601 streambed alteration agreement (dated August 15, 2002,) for the proposed project. A complete administrative record of this consultation is on file at the Sacramento Area Office of NOAA Fisheries.

II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to authorize a five-year RGP for the maintenance dredging and modification of diversions in the South Delta pursuant to section 10 of the Rivers and Harbors Act (1890 and 1899) and section 404 of the Clean Water Act (1973). Project actions are anticipated to occur between August 1 and October 14 of each year within the South Delta, and may involve up to 128 diversions. However, the project proponent, DWR, anticipates that the actual number of diversions that will need the project's actions will be considerably less than this, and will probably amount to only a few dozen at most.

The South Delta Diversions Dredging and Modification project is intended to alleviate the inability of agricultural water users (diverters) to obtain water through existing diversions due to low water levels in the South Delta caused by the operations of the CVP and the SWP. The proposed project's activities are independent of but will occur contemporaneously with the South Delta Temporary Barriers project, which NOAA Fisheries consulted on earlier (NOAA Fisheries 2001) and involves the annual installation *(i.e.,* from April 1-November 30) of four temporary rock barriers in the following locations to either raise water levels during the irrigation season (Numbers 1 through 3) or to improve the outmigration of San Joaquin River basin fall-run Chinook salmon *(O. tshawytscha)* (Number 4):

1. *Old River near Tracy:* in Old River 0.5 miles east of the Delta-Mendota intake;

2. *Middle River near Victoria Canal:* in Middle River about 0.5 mile south of the confluence of Middle River, Trapper Slough, and North Canal;

3. *Grant Line Canal near Tracy Road Boulevard Bridge:* in Grant Line Canal, approximately 400 feet east of the bridge;

4. *Head of Old River:* in Old River 0.1 miles west of the confluence of the San Joaquin River and Old River.

A. Project Activities

DWR has indicated that initial actions may involve temporary measures such as using portable pumps to alleviate diversion problems. More permanent solutions may include maintenance dredging in and around impacted water diversions to insure adequate intake flow to agricultural diverters. If the dredging solution fails to improve the intake flow, then modifications to, or replacement of, existing diversions potentially could occur. Although specific diversions that will require dredging or structural modifications under this action cannot be identified at this time, all of the potential sites are within the boundaries of the described action area and are under the jurisdiction of the South Delta Water Agency.

During the time of year when the temporary barriers are in operation *(i.e.,* April 1-November 30), DWR, in conjunction with the South Delta Water Agency, will determine whether low water levels are affecting the ability of a diverter to obtain an adequate volume of water through the operation of the diverter's normal diversion facilities. If a low water determination is made, DWR and the diverter will determine if the installation and operation of one or more portable pumps near the existing diversion can alleviate the shortfall of diverted water volume.

DWR may make the decision to install portable equipment in advance of low water level conditions if the projected levels are likely to cause diversion difficulties for a diverter. Portable pumps will be sized to divert only a quantity of water that is equal to the volume of water normally diverted from the river channel under normal operating conditions. In addition, they will only be utilized as long as the low water conditions remain and the existing diversion is impacted by those conditions. Once the existing diversion is put back into operation or the low water conditions abate, the portable pumps will be removed from the area.

In response to chronic diversion difficulties at a given diversion facility, DWR anticipates implementing permanent solutions. The primary option involves localized dredging near the inlet of the problem diversion. Secondary options include modifying and/or relocating existing diversion facilities.

1. Dredging

DWR plans on utilizing sealed clamshell dredges for this project. Clamshell dredges have a bucket of hinged steel with a "clamshell" shape that is suspended from a crane. The bucket has a sealed gasket around the metal flange of the bucket which seals in sediments and water thereby reducing sediment discharge from the clamshell bucket as it is raised from the bottom. This significantly reduces turbidity in the upper water column. The crane is mounted on a barge that is floated into position and then anchored. The bucket, with the opposing jaws open, is lowered to the bottom substrate. The force of the bucket hitting the bottom causes the bucket to "bite" a section of substrate. As the bucket is hoisted back up, the jaws of the bucket close, carrying the "bite' of sediment back to the surface. The sediment is then placed either on a contained barge for transport to a disposal site or placed over the levee bank into settling ponds for eventual re-use. The clamshell dredge is particularly well suited to work in shallow waters or confined areas near shoreline structure or obstructions (Nightingale and Simenstad 2001). DWR plans to reduce turbidity during dredging operations by using silt screens to localize sediment movement and reduce or eliminate sediment transport to adjacent waters. Disposal of the dredge spoils will be to adjacent upland disposal sites, either on the landward side of adjacent levees or to the dredge spoils containment area on Fabian Tract. Containment dikes and circulation ditch facilities will be constructed in the areas receiving dredge spoils. Dredge materials will be allowed to settle and the decant water allowed to flow into the circulation ditch. Once decanting is completed, the decant water will be pumped back into the river channel. The dredged material will be left to dry in place and then reused for bank stabilization or other projects.

2. Diversion Modifications/ Relocation

The specific work to be done at a given diversion location will be determined on a case-by-case basis by DWR and the diverter. It will be the minimal amount needed to allow continued and reliable diversion of water for irrigation. The action will not provide for any additional water to be diverted that would exceed that which has been historically diverted through the current diversion. Likely modifications may include work such as: (1) removing the existing diversion and replacing the structure with a new one at a nearby site; (2) relocating the existing structure to a nearby location which may offer more favorable diversion conditions; (3) lowering or extending the existing intake further into the river channel; (4) replacing the existing diversion with a different type of diversion that would more reliably supply irrigation water, *e.g.* replacing a siphon with a turbine pump. Examples of work that might be done are shown in Appendix (1).

B. Proposed Conservation Measures

In addition to the previously mentioned turbidity control measures, DWR plans to avoid and minimize impacts to listed species by conducting dredging and in-water construction activities during weekday daylight hours between August 1 and October 14 of each irrigation season, beginning in 2003 and ending in 2007. Dredging will be limited to that necessary to remove accumulated sediments near diversion intakes that prevent the normal operation of that facility and will not exceed the maximum allowable under the RGP. Currently this is defined in the RGP as "the minimum necessary to restore the waterway within the immediate vicinity of the structure to the approximate dimensions that existed when the structure was built, but cannot extend further than 200 feet in any direction from the structure" (Nationwide Permit Number 3).

DWR proposes to perform daily water quality monitoring both upstream and downstream of the dredge site in accordance with permit conditions and to insure that the water quality criteria for the California Toxics Rule (CTR) and the 1998 Water Quality Control Plan (Basin Plan) for the Sacramento/San Joaquin River Basins are being met. Finally, DWR has indicated that compensation for the loss of shallow water habitat *(i.e.,* 3 meters or less MLW) resulting from dredging activities will be purchased from an established mitigation bank at the ratio of 3:1 new habitat to habitat lost.

C. Action Area

The project action area will include portions of Grant Line and Fabian-Bell Canals, Middle River, Old River, North Canal, and Victoria Canal within the South Delta (Figures 1 and 2). The action area includes approximately 128 diversions that potentially may be the recipient of project actions.

D. Administration of the Programmatic Biological Opinion

Once individual projects or groups of proposed projects can be described in appropriate detail and the standardized terms and conditions incorporated into their design, the Corps will provide NOAA Fisheries with a notification of the project and request our concurrence that the actions are covered by this biological opinion. NOAA Fisheries will review the action notification from the Corps and respond in writing within 30 days. If NOAA Fisheries concurs with the Corps, the action will be appended or tiered to this consultation and an incidental take statement will be prepared, if necessary. Specifically, NOAA Fisheries anticipates responding in one of three ways to project notifications:

1. A response letter to the Corps indicating that the project(s) shall be appended to this programmatic biological opinion providing that the proposed project(s) are consistent with the standards analyzed in this opinion, and that all adverse effects associated with the proposed project(s) have been minimized to such an extent that they become discountable;

2. A tiering letter, which will include an incidental take statement, shall be provided to the Corps if NOAA Fisheries determines that the effects of the proposed project(s) are consistent with the standards analyzed with this programmatic biological opinion, all adverse effects associated with the proposed project(s) have been minimized, and yet incidental take is expected to occur; or

3. A response letter to the Corps indicating that NOAA Fisheries has determined that the proposed project(s) cannot be covered under this programmatic biological opinion, and

that individual consultation is required unless the proposed project is resubmitted with appropriate modifications to make it consistent with the programmatic biological opinion.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the South Delta Diversions Dredging and Modification project on the following federally listed species:

(1) Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)--endangered;
(2) Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)--threatened; and
(3) Central Valley steelhead (*Oncorhynchus mykiss*)--threatened.

A. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

1. Sacramento River Winter-run Chinook Salmon ESU

The Sacramento River winter-run Chinook salmon was formally listed as threatened in November 1990 (55 FR 46515), and was reclassified as endangered under the ESA on January 4, 1994 (59 FR 440). On June 16, 1993 (58 FR 33212), NOAA Fisheries designated critical habitat for the winter-run Chinook salmon. The first adult winter-run Chinook salmon migrants appear in the Sacramento-San Joaquin River system during the early winter months (Skinner 1962). Within the Delta, winter-run adults begin to move through the system in early winter (*i.e.*, November-December), with the first upstream adult migrants appearing in the upper Sacramento River during late December (Vogel and Marine 1991). Adult winter-run presence in the upper Sacramento River system peaks during the month of March. The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Spawning occurs primarily from mid-April to mid-August with peak activity occurring in May and June in the river reach between Keswick Dam and the Red Bluff Diversion Dam (RBDD) (Vogel and Marine 1991). The majority of winter-run Chinook salmon spawners are three years old, although some two-year-old and four-year-old fish are also present.

Chinook salmon spawning occurs predominately in clean, loose, gravel in swift, relatively shallow riffles or along the margins of deeper runs. The fry begin to emerge from the gravel in late June to early July and continue through October (Fisher 1994), generally at night. After emergence, fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris. When the juvenile salmon reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energetic expenditures. Emigration of juvenile winter-run Chinook past the RBDD may occur as early as late July or August, but generally peaks in September and can extend into the next spring in dry years (Vogel and Marine 1991). In the mainstems of larger rivers, juveniles tend to migrate along the margins of the river, rather than in the increased velocity found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, the juvenile salmon inhabit the surface waters (Healy and Jordan 1982).

Juvenile winter-run Chinook salmon occur in the Sacramento-San Joaquin Delta from October through early May based on data collected from trawls, beach seines, and salvage records at the State and Federal water projects (DFG 1998). The peak of juvenile arrivals is from January to March. They tend to rear in the freshwater upper delta areas for about the first two months (Kjelson *et al.* 1981, 1982). As they mature, Chinook fry and fingerlings prefer to rear further downstream where ambient salinity is up to 1.5 to 2.5 parts per thousand (Healy 1980, 1982; Levings *et al.* 1986).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels and sloughs (McDonald 1960; Dunford 1975). Cladocerans, copepods, amphipods and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson *et al.* 1982; Sommer *et al.* 2001). Shallow water habitats are more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer *et al.* 2001). Optimal water temperatures for the growth of juvenile Chinook salmon in the Sacramento-San Joaquin Delta are 54°-57° F (Brett 1952). In Suisun and San Pablo Bays water temperatures reach 54° F by February in a typical year. Other portions of the Delta do not reach this temperature until later in the year, often not until after spring runoff has ended.

Juvenile Chinook salmon follow the tidal cycle in their movements within the estuarine habitat, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levy and Northcote 1981; Levings 1982; Healey 1991). As juvenile Chinook salmon increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tide into shallow water habitats to feed (Allen and Hassler 1986). Kjelson *et al.* (1982) reported that juvenile Chinook also demonstrated a diurnal migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. During the night, juveniles were distributed randomly in the water column, but would school up during the day into the upper 3 meters of the water column. Fry remain in the estuary until they reach a fork length of about 118 mm *(i.e.,* 5 to 10 months of age). Emigration from the delta may begin as early as November and continue through May (Fisher 1994; Myers *et al.* 1998).

Winter-run Chinook salmon are particularly susceptible to extinction due to the limitations of access to suitable spawning grounds and the reduction of their genetic pool to one population (NOAA Fisheries 1997). The winter-run Chinook salmon also has lower fecundity rates than other races of Chinook salmon in the Central Valley, averaging 1000 to 2000 eggs less per female than the other runs. Sacramento River winter-run stock average 3,700 eggs per female fish, while late fall-run fish have an average of 5,800 eggs per female, spring-run females average 4,900 eggs per fish , and fall-run fish average 5,500 eggs per a female (Fisher 1994).

Both environmental and anthropogenic mediated changes to the habitat have led to declines in the Sacramento River winter-run populations (see Figure 3) over the past three decades.

2. Central Vallev Spring-run Chinook Salmon ESU

NOAA Fisheries listed Central Valley spring-run Chinook salmon as threatened on September 16, 1999 (50 FR 50394). Many of the same factors described above that have led to the decline of the Sacramento River winter-run Chinook salmon ESU are also applicable to the Central Valley spring-run ESU, particularly the exclusion from historical spawning grounds found at higher elevations in the watersheds. Historically, spring-run Chinook salmon were abundant throughout the Sacramento and San Joaquin River systems. They constituted the dominant run of salmon in the San Joaquin River system prior to being extirpated by the construction of low elevation dams on the main tributaries of the watershed. Spring-run Chinook salmon typically spawned in higher elevation watersheds such as the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit Rivers. Currently, spring-run Chinook salmon cannot access most of their historical spawning and rearing grounds in the Central Valley due to the construction of impassable dams in the lower portions of the Central Valley's waterways. Today, the only streams that are considered to harbor naturally spawning wild stocks of spring-run Chinook salmon are Mill, Deer and Butte creeks. All of these creeks are east-side creeks that do not have a major dam or migration barrier. Some additional spawning occurs in the Feather River mainstem and the Sacramento River. However, the genetic characteristics of these fish suggest introgression with both spring-run and fall-run hatchery fish. Elevated water temperatures, agricultural and municipal water diversions, regulated water flows, entrainment into unscreened or poorly functioning screened diversions, and riparian habitat degradation all have negatively impacted the spring-run Chinook salmon ESU.

Adult Central Valley spring-run Chinook salmon migrate into the Sacramento River system between March and July, peaking in May through June. They hold in coldwater streams at approximately 1500 feet above sea level prior to spawning, conserving energy expenditures while their gonadal tissue matures. They spawn from late August through early October, peaking in September (Fisher 1994; Yoshiyama *et al.* 1998). Between 56 to 87% of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are three year olds (Calkins *et al.* 1940; Fisher 1994). Spring-run Chinook salmon fry emerge from the gravel from November to March and spend about 3 to 15 months in freshwater habitats prior to emigrating to the ocean (Kjelson *et al.* 1981). Downstream emigration by juveniles occurs from November to April. Upon reaching the Delta, juvenile spring-run Chinook salmon forage on the same variety of organisms while utilizing the same type of habitats as previously described for Sacramento River winter-run Chinook salmon juveniles.

Adult escapement/spawning stock estimates for the past thirty years have shown a highly variable population for the Central Valley spring-run Chinook ESU. Even though the abundance of fish may increase from one year to the next, the overall average population trend has a negative slope during this time period (see Figure 4). These variations in annual population levels may result from differences in individual tributary cohort recruitment levels. Central Valley spring-run Chinook salmon, like Sacramento River winter-run Chinook salmon, have a lower fecundity than the larger sized fish of the Central Valley fall/ late fall-runs of Chinook salmon. This, coupled with the need for cold water to over-summer in while waiting for gonadal tissue to mature, places the Central Valley spring-run Chinook salmon population at a higher risk for population declines than the fall/late fall-run populations. Warmer summer water temperatures increase the likelihood of disease and lowered fertility in fish that have to hold in sub-optimal conditions.

3. Central Valley Steelhead

On March 19, 1998, NOAA Fisheries listed the Central Valley steelhead as threatened (63 FR 13347). Historically, Central Valley steelhead once were found throughout the Sacramento and San Joaquin drainages, where waterways were accessible to migrating fish. Steelhead historically were present in the upper San Joaquin River basin, above the current Friant Dam location. Steelhead commonly migrated far up tributaries and into headwater streams where cool, well oxygenated waters are present year-round. Currently, within the Central Valley, viable populations of naturally produced steelhead are found only in the Sacramento River and its tributaries (FWS 1998). Wild steelhead populations appear to be restricted to tributaries on the Sacramento River below Keswick Dam, such as Antelope, Deer, and Mill creeks, and in the Yuba River, below Englebright Dam (McEwan and Jackson 1996). At this time, no significant populations of steelhead remain in the San Joaquin River basin (FWS 1998). However, small persistent runs still occur on the Stanislaus and perhaps the Tuolumne Rivers. Steelhead are found in the Mokelumne River and Cosumnes River, but may be of hatchery origin. It is possible that other naturally spawning populations exist in other Central Valley streams, but are not detected due to a lack of sufficient monitoring and genetic sampling of presumed resident rainbow trout (Interagency Ecological Program (IEP) Steelhead Project Work Team 1999).

Central Valley steelhead are all considered to be winter-run steelhead (McEwan and Jackson 1996), which are fish that mature in the ocean before entering freshwater on their spawning migrations. Prior to the large scale construction of dams in the 1940s, summer steelhead may have been present in the Sacramento River system (IEP Steelhead Project Work Team 1999). The timing of river entry is often correlated with an increase in river flow, such as occurs during freshets and precipitation events with the associated lowering of ambient water temperatures. The preferred water temperatures for migrating adult steelhead are between 46° and 52° F (Reiser and Bjornn 1979). Entry into the river system occurs from July through May, with a peak in late September. Spawning can start as early as December, but typically peaks between January and March, and can continue as late as April, depending on water conditions (McEwan and Jackson 1996). Steelhead are capable of spawning more than once (iteroparity) as compared to other salmonids which die after spawning (semelparity). However the percentage of repeat spawning often is low, and is predominated by female fish (Busby *et al.* 1996). Steelhead prefer to spawn in cool, clear streams with suitable gravel size, water depth, and water velocities. Ephemeral streams may be used for spawning if suitable conditions in the headwaters remain during the dry season and are accessible to juvenile fish seeking thermal refuge from excessive temperatures and dewatering in the lower elevation reaches of the natal stream (Barnhart 1986).

In Central Valley streams, fry emergence usually occurs between February and May, but can occur as late as June. After emerging from the gravel, fry migrate to shallow, protected areas associated with the margins of the natal stream (Barnhart 1986). Fry will take up and defend feeding stations in the stream as they mature, and force smaller, less dominant fry to lower quality locations (Shapovalov and Taft 1954). In-stream cover and velocity refugia are essential for the survival of steelhead fry, as is riparian vegetation, which provides overhead cover, shade, and complex habitats. As fry mature, they move into deeper waters in the stream channel, occupying riffles during their first year in fresh water. Larger fish may inhabit pools or deeper runs (Barnhart 1986). Juvenile steelhead feed on a variety of aquatic and terrestrial invertebrates, and may even prey on the fry and juveniles of steelhead, salmon, and other fish species. Steelhead juveniles may take up residence in freshwater habitat for extended periods of time prior to emigrating to the ocean. Optimal water temperatures for fry and juveniles rearing in freshwater is between 45° and 60° F. The upper lethal limit for steelhead is approximately 75° F (Bjornn and Reiser, 1991). Temperatures over 70° F result in respiratory distress for steelhead due to low dissolved oxygen levels.

Steelhead typically spend one to three years in freshwater before migrating downstream to the ocean. Most Central Valley steelhead will migrate to the ocean after spending two years in freshwater, with the bulk of migration occurring from November to May, although some low levels may occur during all months of the year. The out-migration peaks from April to May on the Stanislaus River whereas the American River has larger smolt-sized fish emigrating from December to February and smaller sized steelhead fry coming through later in the spring (March and April). Feather River steelhead smolts are observed in the river until September, which is believed to be the end of the outmigration period (CalFed 2000a).

Over the past 30 years, the naturally spawned steelhead populations in the Upper Sacramento River have declined substantially (Figure 5). Central Valley steelhead are susceptible to population declines due to the lack of cool summer water temperature required for the survival of juvenile fish. Summer water flows for many tributaries are influenced by water diversions to support agriculture. Instream flows are frequently reduced, and the ambient water temperatures in the tailwater sections of the tributaries may exceed the tolerances of juvenile steelhead, thereby causing morbidity and mortality in the fish inhabiting these sections.

B. Habitat Condition and Function

The freshwater habitat of salmon and steelhead in the Sacramento-San Joaquin drainage varies in function, depending on location. Spawning areas are located in accessible, upstream reaches of the Sacramento or San Joaquin Rivers and their watersheds where viable spawning gravels and water conditions are found. Spawning habitat condition is strongly affected by water flow and quality - especially temperature, dissolved oxygen, and silt load - all of which can greatly affect the survival of eggs and larvae.

Migratory corridors are downstream of the spawning areas and include the Sacramento-San Joaquin Delta. These corridors allow the upstream passage of adults and the downstream emigration of outmigrant juveniles. Migratory habitat condition is strongly affected by the presence of barriers which can include dams, unscreened or poorly screened diversions, and degraded water quality.

Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing (Maslin 1999). Rearing habitat condition and function may be affected by annual and seasonal flow and temperature characteristics. Specifically, the lower reaches of streams often become less suitable for juvenile rearing during summer. Rearing habitat condition and function are strongly affected by habitat complexity, food supply, and presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system *(e.g.,* the lower Cosumnes River, Sacramento River reaches with setback levees [i.e., primarily located upstream of the City of Colusa]); however, the channelized, leveed, and rip-rapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators.

C. Factors Affecting the Species and Habitat

Sacramento River winter-run and Central Valley spring-run Chinook salmon, as well as Central Valley steelhead historically all utilized higher elevation watersheds for holding, spawning, and rearing. For example, winter-run Chinook salmon historically spawned in the headwater reaches of the little Sacramento, McCloud and Lower Pit River systems, which had cool, stable temperatures for successful egg incubation over the summer. Populations of winter-run Chinook may have numbered over 200,000 fish (Moyle *et al.* 1989; Rectenwald 1989; Yoshiyama *et al.* 1998). Construction of Shasta Dam blocked access to all of the winter-run Chinook salmon's historical spawning grounds by 1942. Preservation of a remnant winter-run population was achieved through manipulation of the dam's releases to maintain a cold water habitat in the Sacramento River below the dam as far downstream as Tehama. Other large dams constructed on the natal streams *(e.g.,* the American, Feather and Yuba Rivers) of Central Valley spring-run Chinook salmon and Central Valley steelhead resulted in the loss of access to much of the historical spawning and rearing habitat of these species. Current spawning areas located downstream of dams often are subject to flow and temperature fluctuations and consequent egg and larval mortality resulting from reservoir operation.

Dam construction also has led to alterations in the hydrology of the Sacramento-San Joaquin River system. This has resulted both in reductions in the volume of water flowing through the system and the timing of peak flows that stimulate migratory behavior in both juvenile and adult fish. Currently, less than 40% of historical flows reach San Francisco Bay through the Delta. The reduction in the peak flows has led to alterations in the cycling of nutrients and changes in the transport of sediment and organic matter, which can lead to distinct alterations in the historical distribution of animal and plant communities upon which the juvenile Chinook salmon depend upon for their forage base and for protective cover. Alterations in flow patterns have also reduced freshwater outflows at the western margins of the Delta. This situation has led to fluctuating salinity levels within the western margin of the Delta and has changed the location and extent of the productive mixing zone between saline and fresh water bodies. Changes in the flushing rate and increased residence time of Delta water also has enhanced the degradative effects of an increased input of contaminants and pollutants to the water system.

Other factors affecting the species and habitat *(e.g.,* levee construction and loss of shallow water habitat, Central Valley Project (CVP) and State Water Project (SWP) operations, invasive species, *etc.)* are especially pertinent to the southern Sacramento-San Joaquin Delta *(i.e.,* the action area) and are discussed below under *IV. Environmental Baseline.*

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline "includes the past and present impacts of all Federal, State or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process" (50 CFR § 402.02).

A. Physical Habitat Alteration

The action area, the Sacramento-San Joaquin Delta, historically was dominated by freshwater marsh habitat. Nearly 1,400 km^2 of freshwater marsh in the Delta have been diked and drained primarily to create farmland. Industrialization and urbanization reclaimed even more acreage until today only about 6% of the original 2,200 km^2 area of native wetlands remains (Conomos *et al.* 1985). The original wetlands served as significant foraging areas for numerous species, and enhanced nutrient cycling and retention as well as acting as natural filters to enhance ambient water quality.

A major impact of levee construction has been the conversion of shallow-water habitats that were found along the margins of waterways into deeper rip-rap lined channels. Shallow-water habitats are considered essential foraging habitats for juvenile salmonids, often supporting complex and productive invertebrate assemblages. The substrate that is provided by the stone rip rap is unsuitable for the colonization of native estuarine invertebrate species. Native species *(e.g.,* clams, oligochaetes, chironomids, and amphipods) typically utilize soft substrates for colonization in the estuary rather than hard substrates. Likewise, levee construction has disconnected the rivers and Delta from their historical floodplains. Juvenile salmonids utilize flood plains for foraging and as a refuge from high flow velocities during flood events. Maintenance dredging of the channels can result in increased levels of suspended sediment, the formation of anoxic bottom waters, and increased saltwater intrusion into upstream areas, all of which may cause stress to fish and trigger physiological or behavioral responses.

B. Water and Sediment Quality

The water quality of the Delta has been negatively impacted over the last 150 years. Increased water temperatures, decreased dissolved oxygen levels, and increased turbidity and contaminant loads have degraded the quality of the aquatic habitat for the rearing and migration of salmonids. The California Water Quality Control Board-Central Valley Regional (Regional Board) in its 1998 Clean Water Act §303(d) list characterized the Delta as an impaired waterbody having elevated levels of chlorpyrifos, DDT, diazinon, electrical conductivity, Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene), mercury, low dissolved oxygen (DO), organic enrichment, and unknown toxicities (Regional Board 1998, 2001).

In general, water degradation or contamination can lead to either acute toxicity, resulting in death when concentrations are sufficiently elevated, or more typically, when concentrations are lower, to chronic or sublethal effects that reduce the physical health of the organism, and lessens its survival over an extended period of time. Mortality may become a secondary effect due to compromised physiology or behavioral changes that lessen the organism's ability to carry out its normal activities. For example, increased levels of heavy metals are detrimental to the health of an organism because they interfere with metabolic functions by inhibiting key enzyme activity in metabolic pathways, decrease neurological function, degrade cardiovascular output, and act as mutagens, teratogens or carcinogens in exposed organisms (Rand 1995; Goyer 1996). For listed species, these effects may occur directly to the listed fish or to its prey base, which reduces the forage base available to the listed species.

Sediments can either act as a sink or as a source of contamination depending on hydrological conditions and the type of habitat the sediment occurs in. Sediment provides habitat for many aquatic organisms and is a major repository for many of the more persistent chemicals that are introduced into the surface waters. In the aquatic environment, most anthropogenic chemicals and waste materials including toxic organic and inorganic chemicals eventually accumulate in sediment (Ingersoll *in* Rand 1995).

Direct exposure to contaminated sediments may cause deleterious effects to listed salmonids. This may occur if a fish swims through a plume of the resuspended sediments or rests on contaminated substrate and absorbs the toxic compounds through one of several routes: dermal contact, ingestion, or uptake across the gills. Elevated contaminant levels may be found in localized "hot spots" where discharge occurs or where river currents deposit sediment loads. Sediment contaminant levels can thus be significantly higher than the overlying water column concentrations (U.S. Environmental Protection Agency 1994). However, the more likely route of exposure to salmonids is through the food chain, when the fish feed on organisms that are contaminated with toxic compounds. Prey species become contaminated either by feeding on the detritus associated with the sediments or dwelling in the sediment itself. Therefore, the degree of exposure to the salmonids depends on their trophic level and the amount of contaminated forage base they consume. Response of salmonids to contaminated sediments is similar to water bourne exposures.

C. Water Operations

Operations of the CVP and SWP pumps in the South Delta have significantly altered water flow patterns in the Delta. When exports are high, water is drawn into the southern portions of the Delta through the Delta Cross Channel, Georgiana Slough and Three Mile Slough from the mainstem of the Sacramento River. Likewise, water flow in the lower San Joaquin River can be reversed and drawn towards the pumping facilities through the interconnected waterways of the South Delta. Fish are drawn with these altered flow patterns towards the pumping facility. These alterations in water flow have resulted in fish from both the Sacramento River and the San Joaquin River systems being drawn into the South Delta as a result of the water diversions. Lower survival rates are expected due to the longer migration routes, where fish are exposed to increased predation, higher water temperatures, more unscreened water diversions, degraded water quality, reduced availability of food resources, and entrainment into the CVP/SWP export facilities near Clifton Court Forebay in the South Delta (FWS 1990, 1992). Currently, the CVP/SWP pumping facilities are operated to avoid pumping large exports of water during critical migratory or life stage phases of listed fish. Real time monitoring of fish movements, and the development of more efficient fish screens have led to a decrease in the numbers of fish lost to the projects, but entrainment still accounts for significant losses to the listed fish populations. Additionally, Herren and Kawasaki (2001) reported that the Delta region had 2,209 other diversions based upon their field observations. Of these diversions, 90% measured between 12 and 24 inches and only 0.7% had screens on the intakes designed to protect fish from entrainment.

D. Invasive Species

Invasive species greatly impact the growth and survival of juvenile salmonids in the Delta. Non-native predators such as striped bass, largemouth bass, and other sunfish species present an additional risk to the survival of juvenile salmonids migrating through the Delta that was not historically present prior to their introduction. These introduced species are often better suited to the changes that have occurred in the Delta habitat than are the native salmonids. The presence of the Asian clam (*Potamocorbula amurensis)* has led to alterations in the levels of phyto- and zooplankton found in water column samples taken in the Delta. This species of clam efficiently filters out and feeds upon a significant number of these planktonic organisms, thus reducing the populations of potential forage species for juvenile salmonids. Likewise, introductions of invasive plant species such as the water hyacinth and *Egeria densa* have diminished access of juvenile salmonids to critical habitat (Peter Moyle, University of California, Davis, personal communication April 25, 2002). *Egeria densa* forms thick "walls" along the margins of channels in the Delta. This growth prevents the juvenile salmonids from accessing their preferred shallow water habitat along the channel's edge. In addition, the thick cover of *Egeria* provides excellent habitat for ambush predators, such as sunfish and bass, which can then prey on juvenile salmonids swimming along their margins. Water hyacinth (*Eichhornia crassipes*) creates dense floating mats that can impede river flows and alter the aquatic environment beneath the mats. DO levels beneath the mats often drop below sustainable levels for fish due to the increased amount of decaying vegetative matter produced from the overlying mat. Like *Egeria,* water hyacinth is often associated with the margins of the Delta waterways in its initial colonization, but can eventually cover the entire channel if conditions permit. This level of infestation can produce barriers to salmonid migrations within the Delta.

The introduction and spread of *Egeria* and water hyacinth have created the need for aquatic weed control programs that utilize herbicides targeting these species. The *Egeria densa* Control Program (EDCP) resulted in the treatment of 1,583 acres in its first two years with diquat and fluridone (Department of Boating and Waterways 2000). Diquat, the active ingredient of Reward®, has been shown to have an acute toxicity to salmonids at concentrations as low as 11 parts per million (ppm) for juveniles and potentially as low as 0.76 ppm for larval fish. Fluridone, the active ingredient of Sonar® has been shown to have an acute toxicity of 7 to 12 ppm in rainbow trout *(O. mykiss*). Both herbicides are expected to have environmental concentrations one to two orders of magnitude lower than acutely toxic levels, but only after complete mixing in the water column. Furthermore, sublethal effects related to the herbicides may occur even at the lower concentrations, and indirect adverse effects from the dieback of the treated aquatic vegetation on water quality may cause take of listed salmonids within the treatment area.

The DBW control program targeting water hyacinth, has been in operation from 1982 through 1999 in the Delta. It has recently been reinstated, and it is expected that a long-term opinion for years 3-5 will be issued this year by NOAA Fisheries. DBW has employed herbicides as the preferred method of control for water hyacinth for 17 years. Chemicals previously utilized in DBW's control program included the aquatic herbicides Weedar®64 (2,4-Dichlorophenoxyacetic acid, dimethylamine salt) (2,4-D), Rodeo® (glyphosate, N-(phosphonomethyl) glycine (isopropylamine salt), and Reward® (diquat dibromide); the adjuvants Activator 90® (alkyl polyoxyethylene ether and free fatty acids), Placement® (amine salts of organic acids, aromatic acid, aromatic and aliphatic petroleum distillate), SR-11® (alkyl aryl polyethoxylates, compounded silicone and linear alcohol), Agri-dex® (paraffin base petroleum oil and polyoxyethylate polyol fatty acid esters), Bivert® (amine salts of organic acids, aromatic acid, aromatic and aliphatic petroleum distillates), and SurpHtac®(polyozyethylated (6) decyl alcohol, 1-aminomethanamide dihydrogen tetraoxosulfate); and the activator Magnify®(ammonium salts, alkyl polyglucoside, and dimethylpolysilozane). From 1983-1999, a total of 17,613 acres were treated with 4,861 applications of primarily 2,4-D (>95% of the total applied herbicides). For the last 6 years of the program, a total of 8,361 gallons of herbicide and 4,914 gallons of adjuvants were used in the Water Hyacinth Control Program (WHCP). An estimated 959 gallons of Weedar®64, 16 gallons of Rodeo®, and 320 gallons of Placement® were applied to Delta waters in the 2001 WHCP season, covering 1002 acres of Delta waters. The DBW estimates that it used a maximum of 1850 gallons of herbicide on 199 sites in the Delta during the 2002 treatment season.

2,4-D has a 96 hour LC_{50} *(i.e.,* lethal concentration at which 50% of exposed test organism die) ranging from 1.4 ppm to 358 ppm with a median of 27.3 ppm for rainbow trout, and a median of 14.8 ppm for Chinook salmon. Glyphosate has a 96 hour LC_{50} of 130 to 210 ppm for salmonids depending on water hardness. Diquat has been shown to have an acute toxicity to salmonids at concentrations as low as 11 parts per million (ppm) for juveniles and potentially as low as 0.76 ppm for larval fish. As stated previously, the herbicides are expected to have environmental concentrations one to two orders of magnitude lower than acutely toxic levels, but only after complete mixing in the water column. Sublethal effects related to the herbicides may occur even at the lower concentrations, and indirect adverse effects from the dieback of the treated aquatic vegetation on water quality may cause take of listed salmonids within the treatment area.

E. Habitat Restoration and Environmental Monitoring

Examples of habitat restoration projects conducted under the auspices of CalFed in the Delta region include large scale restoration projects on the Mokelumne and San Joaquin Rivers, purchase of additional upstream flows, and improvement of water quality throughout the watershed (CalFed 2000b). In general, habitat restoration projects are expected to increase habitat complexity or quality, and increase the growth and survival of rearing salmonids by creating conditions that increase the food supply or improve conditions for feeding and successful migration, and decrease the probability of predation.

FWS' Anadromous Fish Restoration Plan (AFRP) has developed numerous actions in the Delta specifically intended to improve the outmigration and survival of juvenile salmon in the Delta *(e.g.,* Delta Cross Channel closures, export curtailments, positive Q west conditions [positive delta outflow]) (FWS 1998). AFRP actions also include non-flow fish management projects such as physical facilities to improve fish passage, channel restoration to improve rearing habitat and migration corridors, and fish screen installation to prevent the entrainment of juvenile fish.

The information gathered by the Interagency Ecological Program (IEP) monitoring program is used to adjust operations of the CVP and SWP. IEP projects explore predator-prey relationships; fish abundance and size distribution; geographic distribution; population studies; impacts from water operations; nursery values; entrainment monitoring; and fish screen criteria development. These projects serve not only to improve environmental conditions in the Delta, but also expand the knowledge base of the Delta's ecosystem. However, routine fish surveys conducted within the Delta almost universally results in the bycatch of listed salmonids, and thereby constitute an added source of mortality.

V. EFFECTS OF THE ACTION

Pursuant to section 7(a)(2) of the ESA (16 U.S.C. § 1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of the South Delta Diversions Dredging and Modification project on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook, salmon and threatened Central Valley steelhead. The South Delta Diversions Dredging and Modification project is likely to adversely affect listed species and critical habitat through installation of temporary portable pumps, dredging activities and the operation of relocated, modified, or unscreened agricultural diversions. In the *Description of the Proposed Action* section of this Opinion, NOAA Fisheries provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NOAA Fisheries provided an overview of the threatened and endangered species that are likely to be adversely affected by the activity under consultation.

Regulations that implement section 7(a)(2) of the ESA require that biological opinions evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. § 1536; 50 CFR 402.02).

NOAA Fisheries generally approaches "jeopardy" analyses in a series of steps. First, NOAA Fisheries evaluates the available evidence to identify direct and indirect physical, chemical, and biotic effects of the proposed actions on individual members of listed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to a species' environment - such as introducing exotic competitors or a sound). Once NOAA Fisheries has identified the effects of the action, the available evidence is evaluated to identify a species' probable response, including behavioral reactions, to them. These responses then will be assessed to determine if they can reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). The available evidence is then used to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

A, Approach to Assessment

1. Information Available for the Assessment

To conduct the assessment, NOAA Fisheries examined an extensive amount of evidence from a variety of sources. Detailed background information on the status of these species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, governmental and non-governmental reports, and scientific meetings, and environmental reports submitted by the project proponents.

2. Assumptions Underlying This Assessment

In the absence of definitive data or conclusive evidence, NOAA Fisheries must make a logical series of assumptions to overcome the limits of the available information. These assumptions will be made using sound, scientific reasoning that can be logically derived from the available information. The progression of the reasoning will be stated for each assumption, and supporting evidence cited.

B. Assessment

Potential adverse effects to listed salmonids are anticipated to occur during the downstream emigration of fry and juveniles during the winter and spring migration periods. The installation of temporary portable pumps, dredging activities and the operation of relocated, modified, or unscreened agricultural diversions are expected to result in the loss of fish through both direct and indirect effects. Project activities below the downstream temporary barriers *(i.e.,* Grant Line, Old River at Tracy, and Middle River) may especially impact early and late emigrating juvenile salmonids that are not protected by the HORB and the concurrent 30-day spring CVP and SWP pumping reductions. NOAA Fisheries believes that dredging and construction activities conducted under the scope of this project are not likely to adversely affect listed salmonids directly because of limitations incorporated by DWR to minimize the exposure of listed salmonids through temporal and spatial restrictions on these activities. During the proposed dredging and in-water construction work window for the action *(i.e.,* August 1-October 14 of each year), listed salmonids are not expected to be in the project area due to elevated water temperatures and the migration patterns of the listed fish. Furthermore, the project's activities are not likely to adversely affect adult salmonids due to the enhanced ability of larger fish in avoiding entrainment into agricultural diversions or actively avoiding construction activities.

1. Agricultural Diversions and Temporary Pumps

Water diversion intakes have long been identified as a major source of larval and juvenile fish mortality (Hatton 1940; Hallock and Woert 1959; Hallock 1977). Fish diverted into power turbines experience up to 40 percent mortality as well as injury, disorientation, and delay of migration (Bell 1991), whereas those entrained into agricultural and municipal water diversions experience 100 percent mortality due to their eventual demise in the agricultural fields or water treatment plants. The three main causes of delay, injury, and mortality of fish at diversion intakes are entrainment, impingement and predation. Entrainment occurs when fish are pulled into the diversion and pass into a canal or turbine. Impingement is defined as fish coming into contact with a screen, a trash rack, or debris at the intake which may cause bruising, scale loss, or abrasions which enhance the likelihood of infection. Chronic impingement or impingement at high velocities often causes direct mortality. Diversions increase the risk of predation by stressing or disorienting fish and consequently making them more vulnerable to predation. The physical structure of an intake may also increase the predation risk to fish by providing habitat or cover for fish or avian predators (NOAA Fisheries 1994).

The installation of temporary pumps and the modification of agricultural diversions without adequate screening can be expected to entrain fry or juvenile Chinook salmon or steelhead during outmigration periods. At this time, no plans are presented in the project proposal to screen any diversion. A modification to an existing diversion can include changes in the type of diversion system used. Different types of diversions have different water intake velocities depending on their design and size. An increase in the magnitude of the inflow velocity beyond critical swimming speeds for fish, as indicated by metabolic criteria and swimming fatigue (Figures 6 and 7), will lead to fatigue and eventual entrainment of the fish if it does not escape the pump's zone of influence prior to exhaustion (Brett 1995). Likewise the relocation of a diversion may place it in an area that is more environmentally sensitive than its prior location, resulting in a negative impact on the welfare of the listed fish species. The placement of inlet pipes or hoses into the channels of waterways in the South Delta will be typically in shallow water along the margins of the waterbody. Juvenile salmonids are known to utilize the shallow margins of the Delta's waterways for rearing and migration, thus potentially placing them in close proximity to an intake, particularly if the new diversion location has habitat that is more attractive to salmonids than the diversion's previous location.

Diversion inlets may concentrate prey fishes (*i.e.,* fry and juvenile salmonids) and create habitat that allows more efficient predation by aquatic predators. Even very small variations in the aquatic habitat may create low velocity refuges where predators can hold and efficiently ambush juvenile salmonids as they move by in the current. Likewise structures that provide perching opportunities above the inlet can allow birds to wait for prey to hold below them. Juvenile fish that are exhausted, disoriented or stunned from encountering the diversion are easily preyed upon by localized predators.

Formerly impacted diversions that are modified either by dredging or by physical alterations will be able to operate more frequently or with a higher intake flows, thus increasing the potential for entraining fish. Modification or relocation of an impacted pump will lead to an apparent increase in diverted water over current levels as the diversion is restored to its designed capacity.

Of the approximately 128 diversions located within the action area, 21 are in an area which directly impact emigrating salmonids transiting Old River, with an additional 11 diversions on Grant Line Canal that may have some effect. Those diversions on Grant Line Canal that are downstream of the Grant Line temporary barrier may potentially expose listed salmonids to entrainment. These fish would be those that are neither pulled into the Clifton Court Forebay structure during operations of the SWP or into the facilities of the CVP during its operations. The remainder of the 128 diversions in the action area are upstream of the temporary barrier structures; listed salmonids that pass over the barriers during high tidal conditions or pass downstream from the Head of Old River when that barrier is removed in mid-May potentially may encounter these diversions. The potential for this was considered low in the NOAA Fisheries' biological opinion for the Temporary Barriers project (NOAA Fisheries 2001).

The number of diversions that are anticipated to have an affect on salmonid survival within the action area represent approximately one percent of the total number of diversions in the entire Delta region. Of this number, DWR anticipates that only a fraction of the diversions in the project area will actually be dredged or modified under the project's auspices. Therefore, the total area of the action's effects are considerably less than the total area of the entire Delta region. However, the project's actions, including the operation of serviced, unscreened diversions, will result in the take of some, albeit an unknown fraction, of the listed salmonids in the South Delta.

2. Dredging

DWR states in its project description that it intends to minimize the effects of dredging by incorporating several Best Management Practices (BMPs) into its work protocol. The three primary BMPs are:

- Utilizing sealed clamshell dredges that minimizes the resuspension of sediment. This design reduces sediment spill or overflow during the digging, lifting, and exiting of the bucket from the water surface

- Installing silt screens around any dredging site. These screens mechanically block the spread of the sediment plume from the dredging operation and contain it within the immediate dredge site.

- Using the proposed seasonal *(i.e.,* August 1 through October 14), weekly *(i.e.,* Monday-Friday), and diel *(i.e.,* daylight hours) work windows. Salmon and steelhead are much less likely to occur in the project area from August through October as compared to winter and spring months.

NOAA Fisheries believes that dredging activities associated with the South Delta Diversions Dredging and Modification project will affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead in that they will facilitate increasing the use of current diversions as described in the previous section. Otherwise, NOAA Fisheries believes that with the incorporation of the above mentioned avoidance and minimization measures, the dredging activities associated with the proposed project are not likely to directly adversely affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to section 7 of the ESA.

Cumulative effects include ongoing point and non-point storm water and irrigation discharges related to agricultural and urban activities. These discharges contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates. Agricultural practices in the Delta may reduce riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into the Delta. Unscreened agricultural diversions throughout the Delta can potentially entrain all life stages of listed fish. Grazing activities from dairy and cattle operations can degrade or reduce suitable habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the Delta.

The Delta region, which includes portions of Contra Costa, Alameda, Sacramento, San Joaquin, Solano, Stanislaus and Yolo counties, is expected to increase its population by nearly 3 million people by the year 2020 (California Commercial, Industrial and Residential Real Estate Services Directory 2002). Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns.

Increased urbanization is expected to result in increased boating activity which will necessarily increase wave action and prop wash in Delta waterways. This increase will degrade riparian and wetland habitat through channel bank erosion, increased siltation and turbidity, and churning up benthic sediments. The resulting resuspension of contaminated sediments and degradation of submerged vegetation will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids. Increased watercraft operation in the Delta will also likely result in more oil and gasoline contamination from the operation of two cycle engines on these powered vessels, which will have its own negative impacts on the aquatic environment.

VII. INTEGRATION AND SYNTHESIS

Based on the analysis of impacts caused by diversions on fry and juvenile salmonids and the fact that screening is not an active component of the project description, NOAA Fisheries believes that a proportion of the listed salmonids present in the South Delta, especially during the early part of the Temporary Barriers project operational season, may be adversely affected by the temporary and permanent actions of the project. This period corresponds to the months of April through June, when salvage data from the CVP and SWP indicates that listed fry and juvenile salmonids are likely to be present in the project area (Tables 1-4). Individuals may be directly entrained in diversions or portable pumps, or subject to the increased likelihood of predation, exhaustion, and injury as a result of conditions created by a diversion's operation. These impacts may result in immediate or delayed mortality of affected individuals. Sublethal effects such as reduced growth and impaired health also may occur. NOAA Fisheries believes that maintenance dredging will not be likely to adversely affect listed salmonids, except that it will allow a formerly impacted diversion to operate more often or with a higher intake flow, thus increasing the potential for entraining fish. Modification or relocation of an impacted pump will lead to an apparent increase in diverted water as the diversion is restored to historical riparian water right levels.

Nevertheless, NOAA Fisheries expects the total number of listed salmonid fry and juveniles affected by the impingement, entrainment, or increased predation due to the project's actions to be minor compared to the Central Valley populations of these species as a whole. This determination is based on the patchy distribution of emigrating salmonids fry and juvenile in the action area, the small number of impacted diversions in the action area *(i.e.,* less than one percent of Delta diversions), and the relative size of the action area compared to the entire Delta as a whole. These conditions reduce the probability that listed salmonids will be within the zone of influence from an impacted diversion's intake when it is in operation. The loss of this small proportion of fish from the larger ESU population should not have a significant effect on the viability of the population's replacement cohort, the long-term stability of the ESU population, or the diversity of the gene pool for the affected populations.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead, the environmental baseline for the action area, the effects of the proposed South Delta Dredging and Modification project, and the cumulative effects, it is NOAA Fisheries' biological opinion that the South Delta Diversions Dredging and Modification project, as proposed, is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, or Central Valley steelhead.

Notwithstanding this conclusion, NOAA Fisheries anticipates that some activities associated with this project may result in the incidental take of these species. Therefore, an incidental take statement is included with this programmatic biological opinion to serve as a standardized guideline for the Corps and DWR in developing **projects** authorized under the RGP.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NOAA Fisheries as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section **7(b)(4)** and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the DWR, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered in this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions of the incidental take statement **and/or** (2) fails to require DWR to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and the DWR must report the progress of the action and its impact on the species to NOAA Fisheries as specified in this incidental take statement (50 CFR § 402.14 **(I)(3))**.

Due to the programmatic nature of the proposed action, the Corps and NOAA Fisheries are unable to identify the specifics of future actions. Therefore, while NOAA Fisheries is able to broadly evaluate the potential effects to the listed species from the program, we cannot determine the specific incidental take that will occur at this time. For this reason the take will be quantified and exempted at the project specific level, and thus, the exemption of incidental take for future activities under the program does not take effect until such time as approval of individual project applications by NOAA Fisheries has occurred.

This incidental take statement is applicable to the operations of the five-year RGP for the Dredging and Modification of Selected Diversions of the South Delta project as described in the Proposed Mitigated Negative Declaration and Initial Study (April 2002), authored by the

Department of Water Resources and submitted by the Corps to NOAA Fisheries on June 19, 2002. All diversions that are actually dredged or modified by the proposed actions will have incidental take coverage as stipulated under the terms of section 7(b)(4) and section 7(o)(2) of the ESA during the temporary barriers operational season *(i.e.,* April 1-November 30) for the duration of the five-year Corps RGP, providing that the terms and conditions of this programmatic biological opinion are implemented. The incidental take coverage for this programmatic biological opinion will terminate five years after the signing of the opinion or when the Corps' five-year RGP expires, whichever occurs later. After the permit lapses, or during periods outside of the temporary barriers operational season, incidental take of listed salmonids by water diverters will not be exempt from the take prohibitions of section 9 of the ESA under the authority of this programmatic biological opinion and authorized activities tiered to it.

A. Amount or Extent of Take

The amount or extent of incidental take resulting from future actions proposed under the DWR South Delta Diversions Dredging and Modification project cannot be easily quantified here due to uncertainty in the scope and location of these actions. Incidental take resulting from these actions will be specified and exempted by NOAA Fisheries at the time of annual project-level review and approval. However, based on our analysis of possible effects from the project, a maximum level of incidental take can be described.

NOAA Fisheries anticipates that the proposed DWR South Delta Diversions Dredging and Modification project in San Joaquin County, California, will result in the incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead due to impacts caused by the operation of portable diversions *(i.e.,* pumps), and otherwise increased or altered operations *(e.g.,* changes in operation schedules, increased diversion rates, changed diversion location, *etc.)* of existing diversions that may have been modified or relocated as part of the project's operations. Any incidental take resulting from the project will be limited to emigrating fry and juveniles present in the South Delta project area during the operational season of the Temporary Barriers project. The incidental take is expected to be in the form of death, injury, harassment, and harm.

The numbers of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead directly taken will be difficult to quantify because dead and injured individuals will be difficult to detect and recover. In addition, NOAA Fisheries is unable to anticipate all the possible circumstances related to the continued five-year RGP for the South Delta Diversions Dredging and Modifications project, including programmatic actions or individual projects that might be developed in the future. As a result, NOAA Fisheries is unable to issue a "blanket" incidental take statement or a comprehensive list of all reasonable and prudent measures to cover all programs and actions subsequently implemented pursuant to this RGP. Therefore, NOAA Fisheries will issue a general list of reasonable and prudent measures, with their associated terms and conditions, that will reduce or avoid incidental take if incorporated into forthcoming projects under this RGP. NOAA Fisheries believes that incidental take will include the following:

1. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead fry and juveniles killed from entrainment during the operational season of the Temporary Barriers project *(i.e.,* April 1-November 30) in diversions actually serviced by the proposed project (up to 128 existing diversions, but most likely considerably fewer) within the project area by project activities such as installation of portable pumps, dredging, or modification or relocation to improve their diversion capabilities; and

2. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead fry and juveniles harmed, harassed, or killed from altered habitat conditions *(e.g.,* water depth or velocity changes leading to reduced growth rates or increased probability of predation) in the project area that result from project activities such as installation of portable pumps, dredging, or modification or relocation of up to 128 existing diversions.

B. Effect of the Take

In the accompanying biological opinion, NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

NOAA Fisheries is not authorizing the incidental take of listed salmonids for any specific programmatic action addressed in this biological opinion. Instead, the reasonable and prudent measures and the associated terms and conditions are provided for the purpose of streamlining and expediting future formal consultations for these actions. In cases where NOAA Fisheries concurs with the Corps that the proposed actions are designed to fully incorporate the relevant terms and conditions from this incidental take statement, and that incidental take is either negligible or in compliance with this biological opinion, then NOAA Fisheries will tier the section 7 compliance for such actions to this biological pinion and conclude formal consultation via the appropriate documentation.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead:

1. The Corps and DWR shall avoid or minimize entrainment or impingement of listed salmonid species from diversions within the project area that are subject to the project's actions; and

2. The Corps and DWR shall avoid or minimize alterations to aquatic or riparian habitats.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps and DWR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The Corps and DWR shall avoid or minimize entrainment or impingement of listed salmonid species from diversions within the project area that are subject to the project's actions.

a. Following the determination that a diversion is substantially impacted by low water levels, DWR shall make available to NOAA Fisheries that diversion's water use records from the previous ten years, indicating the quantities and rates of water diverted from the impacted diversion site. This data will be used by NOAA Fisheries to more accurately assess project impacts to listed salmonids and will allow for NOAA Fisheries to verify that the historical diversion amounts are not being exceeded as stipulated in the project description.

b. Temporary pumps shall be fitted with a screen that has a mesh size with a maximum opening diameter of 3/32 inch for pores, 0.069 inches for bars, and 0.087 inches for woven wire. These screens will reduce entrainment of both fry and juveniles that may be present in the action area. Approach velocities shall meet screening guidelines developed by NOAA Fisheries. Guidance for water drafting and small pump screens are included in Appendices 2 and 3.

c. Inlets for temporary pumps shall be placed along straight sections of the river channel at the maximum depth possible, with the river current parallel to the pump's intake orifice. Avoidance of concentrating flows, turbulent flows and near-shore positions should be included in the pump location analysis to reduce the exposure of listed salmonid fry and juveniles to the screened inlet.

d. Extensions of existing diversions into deeper water and relocation of diversions within 100 yards of their existing location without any change in the type of diversion *(i.e.,* gravity fed, vertical pump, or slant pump) may proceed without initiating a new section 7 consultation with NOAA Fisheries, provided that such actions take place during the August 1 to October 14 in-water work window. Relocation of diversions within the 100-yard limit shall not place the diversion inlet into a more sensitive aquatic area *(i.e.,* back eddies, shaded riparian areas, *etc.)* where listed salmonid fry and juveniles would tend to congregate. NOAA

Fisheries shall be notified of any actions of this type at least two weeks prior to implementation. Modifications which involve changes in the type of diversion (*i.e.,* gravity to vertical turbine pump) and those that relocate further than 100 yards will be considered new diversions, and will not be covered under this five-year RGP for maintenance activities.

e. The Corps and DWR shall consult with NOAA Fisheries on the design and implementation of a diversion entrainment monitoring plan within the action area. The plan shall include monitoring of salmon and steelhead entrainment by a statistically representative number of agricultural diversions upon which the project has undertaken maintenance. The monitoring plan shall be sent to NOAA Fisheries for review and approval prior to implementation, and shall include a description of the proposed monitoring activities, locations, and schedule. If appropriate, authorization for take associated with implementation of the fishery sampling plan will be provided upon NOAA Fisheries' approval of the sampling program. During the five-year period of the permit, diverters and DWR shall implement measures to reduce and eventually avoid entrainment of listed salmonids through the operations of their diversions (Appendix 4).

f. An annual report summarizing the monitoring program results described in subsection 1(e) shall be sent to the NOAA Fisheries Sacramento Area Office's supervisor at the following address no later than March 1 of each year, starting in year 2004:

Supervisor, Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814
Phone: (916) 930-3600
Fax: (916) 930-3629

2. The Corps and DWR shall avoid or minimize alterations to aquatic or riparian habitats.

a. Stockpiling of construction materials, including portable equipment, vehicles and supplies (including chemicals and their containers) shall be restricted to designated construction storage areas outside of the riparian zone.

b. Heavy equipment use shall be minimized as much as practicable, and equipment shall be modified as necessary to minimize environmental impacts.

c. Equipment shall be fueled and maintained away from the waterways in a designated area equipped to contain spills and prevent hazardous materials, such as fuel and lubricants, from soaking into the soil.

d. BMPs shall be employed that minimize or eliminate the potential for erosion to occur at action sites. Erosion control measures shall be monitored and maintained throughout the construction window, and left in place until the potential for erosion has abated.

e. Confined dredge facilities constructed to receive dredge spoils on the landward side of levees shall meet all necessary State and Federal criteria for such structures. Decant water from such facilities shall meet all State and Federal criteria for wastewater discharge. Copies of any permits issued for these facilities shall be sent to the NOAA Fisheries Sacramento Area Office's supervisor at the address in 1(f).

f. NOAA Fisheries shall be notified of all dredging at least two weeks prior to the start of the action. Notifications should be sent to the address in subsection 1(f).

g. No incidental take of listed salmonids is anticipated from dredging and construction activities associated with this project. NOAA Fisheries shall be notified immediately via fax (contact: Supervisor, Sacramento Area Office at (916) 930-3629) if any salmon or steelhead are found dead or injured within a quarter (0.25) mile either upstream or downstream of the project action site. A follow-up written notification also must be submitted which shall include the date, time, and location of where the carcass or injured specimen was found, a color photograph of the specimen *in situ,* cause of death if known, and the name and affiliation of the person who found the specimen. Written notification shall be submitted to the address in subsection 1(f). Any dead specimens should be placed in an ice chest with ice or held in a refrigerator until it can be picked up by staff from NOAA Fisheries, or an individual designated by NOAA Fisheries to perform this task.

h. DWR shall send quarterly summary reports to NOAA Fisheries at the above address that describe the work performed, the starting and ending dates, observed adverse effects to aquatic habitats *(e.g.,* sediment plumes, spills, changes in current patterns) and their duration, and any other problems encountered during the action implementation. Adverse impacts to any salmon or steelhead associated with the action shall also be reported in the summary.

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(l) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of pertinent information.

1. The Corps and DWR should support anadromous salmonid monitoring programs throughout the Sacramento-San Joaquin Delta, and specifically in the South Delta to improve the understanding of migration and habitat utilization by salmonids in the Delta region.

2. The Corps and DWR should support and promote aquatic and riparian habitat restoration within the Delta region, and encourage agricultural practices that avoid or minimize negative impacts to salmon and steelhead.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of any conservation recommendations.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the June 20, 2002, request for consultation received from the Corps. This biological opinion is valid for the project described for the years 2003 through 2007. As provided for in 50 CFR§402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in any incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the agency action is subsequently modified in a manner that causes an affect to the listed species that was not considered in the biological opinion, or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

XI. LITERATURE CITED

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TABLE 1: State Water Program Steelhead Salvage at Clifton Court Forebay

SWP Steelhead

	MONTH											
YEAR	January	February	March	April	May	June	July	August	September	October	November	December
[illegible]	0	0	766	744	348	84	0	0	12	0	12	24
[illegible]	36	13	55	9	20	60	0	0	0	0	24	120
[illegible]	170	13	25	242	0	0	24	0	0	0	0	48
[illegible]	36	96	384	348	72	0	0	0	0	0	12	0
[illegible]	48	60	1813	710	141	0	0	0	0	0	0	105
[illegible]	41	72	46	76	40	259	0	0	0	0	0	0
[illegible]	0	59	879	141	11	480	0	0	21	1	0	0
[illegible]	0	436	2404	1116	229	40	0	0	12	8	120	0
[illegible]	62	284	1696	341	96	0	0	0	8	8	7	2
[illegible]	6	169	428	123	222	2	1230	0	0	0	5	2268
[illegible]	390	6107	254	86	85	436	0	0	0	0	0	0
[illegible]	15	25	454	1011	969	0	0	0	0	0	20	23
[illegible]	381	835	74	118	210	80	0	0	0	33	0	25
[illegible]	119	1509	3088	4902	0	0	0	0	0	0	0	309
[illegible]	792	1432	1110	10965	2441	179	0	0	0	17	0	0
[illegible]	280	89	0	0	256	0	0	0	0	0	0	0
[illegible]	0	0	41	357	18	0	0	0	0	0	0	22
[illegible]	0	325	1221	1165	647	0	0	0	0	0	0	0
[illegible]	0	139	54	1328	446	0	0	0	0	0	0	1268
[illegible]	0	69	3387	976	446	0	0	0	0	0	0	172
[illegible]	88	2403	823	2116	426	25	0	0	0	0	0	0
[illegible]	46	499	4767	2105	404	0	0	0	0	0	0	0
[illegible]	0	1317	4767	2105	404	0	0	0	0	0	0	0
[illegible]	22	23	5799	91	0	0	0	0	0	92	489	0
[illegible]	148	5418	3867	201	33	0	0	0	0	0	0	16
[illegible]	1330	8561	792	353	200	0	0	0	0	0	0	0
[illegible]	21	107	336	22	61	15	0	0	0	2	0	4
[illegible]	360	362	78	6	86	117	30	0	0	4	0	0
[illegible]	2009	597	190	192	151	7	0	0	0	0	17	17
[illegible]	0	9	88	101	23	0	0	0	0	28	0	30

TABLE 2: Central Valley Program Steelhead Salvage at Tracy

	Month											
Year	January	February	March	April	May	June	July	August	September	October	November	December
[illegible]	492	372	444	1080	0	0	0	0	0	0	0	0
[illegible]	0	0	90	743	126	0	0	0	0	0	0	252
[illegible]	248	1258	1443	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	297	0	0	0	0	0	0	1980
[illegible]	0	0	0	0	0	0	0	0	0	0	14	0
[illegible]	0	0	146	187	70	0	0	0	0	0	0	0
[illegible]	0	83	134	127	68	0	0	0	0	0	0	0
[illegible]	26	524	127	505	238	46	45	0	0	0	0	0
[illegible]	143	112	718	776	275	0	0	0	0	0	0	0
[illegible]	248	0	491	1039	1646	0	0	0	0	0	0	139
[illegible]	0	252	5051	0	0	0	0	0	0	0	0	0
[illegible]	0	1085	2139	786	0	0	0	0	0	0	0	0
[illegible]	95	109	4412	1263	98	0	0	0	0	0	0	0
[illegible]	4216	1788	342	0	0	0	0	0	0	0	0	0
[illegible]	0	3480	3060	684	84	24	0	0	0	0	0	12
[illegible]	30	676	336	22	36	12	0	0	0	0	0	48
[illegible]	12	276	648	228	108	72	0	0	0	0	0	0
[illegible]	1008	838	24	264	84	12	0	0	0	0	0	24
[illegible]	12	0	16E	396	60	12	0	0	0	0	0	12

TABLE 3: State Water Project Chinook Salmon Salvage at **Clifton** Court Forebay

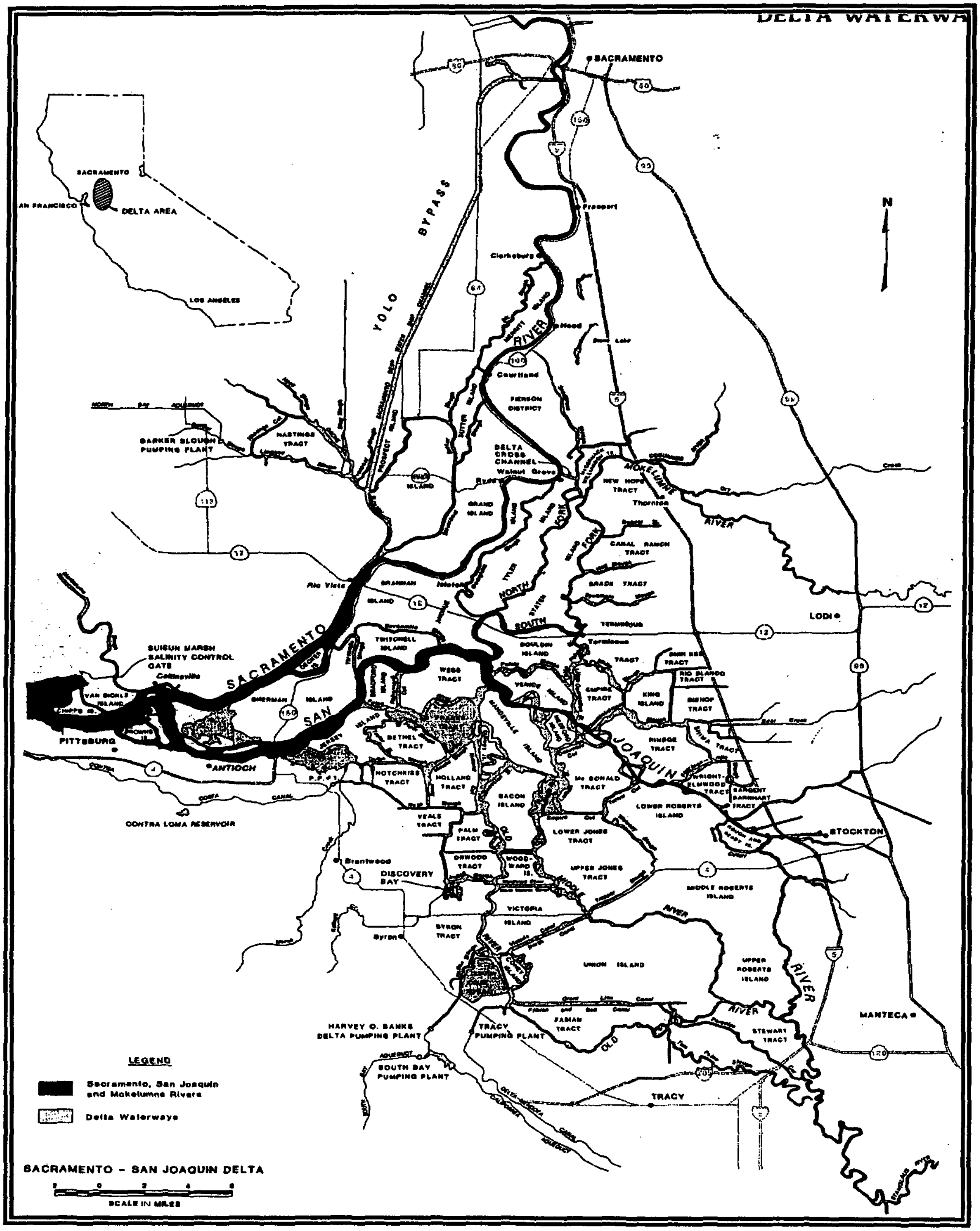
SWP Chinook Salmon Salvage

	MONTH											
YEAR	January	February	March	April	May	June	July	August	September	October	November	December
1968	0	0	3446	10548	13980	1632	120	60	72	300	2772	2556
1969	3420	275	284	14868	24124	3394	212	0	24	136	12	277
1970	1093	1574	1189	10831	12764	6220	2100	540	12	0	3168	14052
1971	223	1431	5528	3892	6012	776	0	0	0	0	0	312
1972	548	150	4822	13520	43387	19540	0	0	385	1407	8588	5390
1973	1648	667	1814	6534	22334	3917	0	0	0	699	1463	3150
1974	907	927	4008	13106	67567	44662	3597	0	1	91	4528	2408
1975	1743	1650	4404	5508	15161	663	27	60	402	2516	3569	2858
1976	961	1005	10287	3040	13688	1602	114	251	24	139	128	642
1977	2224	983	593	68	4522	612	0	0	0	0	269	19068
1978	45621	6668	511	19	3200	12400	632	0	21	37139	653	3736
1979	2399	1187	2304	28993	59790	9533	5647	359	70	1516	5392	5249
1980	5968	383	188	18668	27041	22836	725	725	931	966	943	1462
1981	1756	3504	6327	55039	19115	352	0	85	0	395	2937	12095
1982	6700	26805	22973	28353	110299	24446	0	0	0	0	6086	52757
1983	12509	12758	4796	0	1138	37445	134	0	0	0	162	0
1984	0	80	1739	27260	40078	46130	3	575	0	10514	8859	9883
1985	121	847	2261	28246	96273	8768	408	0	19	719	1099	1952
1986	1639	13422	18900	133773	176557	90240	0	0	0	0	153	549
1987	63	405	4316	40804	95002	9783	573	69	83	2	16	26764
1988	2943	4235	3905	44736	71008	21453	1781	308	24	39	460	1016
1989	2592	170	8319	49525	8964	602	0	70	0	38	755	1277
1990	2463	1103	4668	17377	8964	595	75	0	0	9	0	42
1991	91	99	4765	19904	12268	680	0	0	0	72	1282	9
1992	904	8445	9255	1058	2365	0	0	0	6	0	0	160
1993	1622	956	136	1487	2626	728	8	84	0	22	77	817
1994	193	209	283	269.33	1787	20	0	0	0	0	10	707
1995	5048	1389	18	10	3505	8994	184	12	0	0	0	0
1996	3013	280	444	2637	6586	1583	14	0	10	3	112	46
1997	18	35	1674	6014.2	2962.67	635	30	0	9	8	4	463

TABLE 4: Central Valley Project Chinook Salmon Salvage at Tracy

	MONTH											
YEAR	January	February	March	April	May	June	July	August	September	October	November	December
1957	0	0	3288	116684	85407	11600	512	312	192	0	0	0
1958	0	0	0	0	0	0	528	48	0	0	0	0
1959	0	0	29088	46476	19812	5148	276	84	48	0	0	0
1960	0	0	8868	26340	25140	105584	432	48	0	0	0	0
1961	0	0	4512	21444	25380	18792	408	72	0	0	0	0
1962	0	0	0	20424	58032	13944	312	48	0	0	0	0
1963	0	0	0	0	14040	8196	336	48	60	0	0	0
1964	0	372	1776	30144	57936	39864	888	0	108	0	0	0
1965	0	0	2052	6864	232616	87072	3264	84	192	12	0	0
1966	0	0	11028	68556	23844	14568	288	84	72	96	0	0
1967	0	0	4476	4140	29340	15900	3408	360	24	72	0	0
1968	1236	46857	36768	54312	47256	8584	0	48	1020	4008	6228	744
1969	6328	1152	660	12828	36566	7032	504	0	132	744	0	0
1970	0	25621	57100	135348	26022	17050	180	0	324	276	60	0
1971	0	1200	21504	92700	193116	119156	3456	24	0	144	3360	7464
1972	0	5184	22692	59664	149352	58140	60	12	2880	684	0	0
1973	0	1868	4242	78480	78816	12096	144	0	0	34308	11856	1932
1974	0	980	25544	43476	166916	31668	2328	24	36	1168	0	0
1975	672	2184	8736	35760	51756	13404	432	12	60	252	12	36
1976	0	876	13487	33516	51216	15900	0	216	24	216	240	312
1977	2232	1044	204	1920	5448	1800	0	0	0	0	0	108
1978	0	0	360	984	4332	4260	192	0	0	26592	2448	3480
1979	2784	168	1056	62304	40100	5458	0	0	184	0	745	0
1980	0	125	299	93825	50063	7320	1187	0	0	316	1328	308
1981	95	0	1709	28907	7006	5458	0	0	0	2360	488	6872
1982	2911	5414	13170	6535	95864	68290	295	233	0	0	14635	12814
1983	5952	4110	6149	47667	112807	31935	928	0	0	2302	459	66
1984	162	0	8461	86803	81617	1904	990	0	0	10714	6671	5009
1985	0	7319	4540	46780	59700	1633	103	0	0	8053	3898	5060
1986	1810	401293	34146	67614	189070	46166	10257	0	0	642	75	966
1987	306	504	718	47962	39077	0	0	0	0	0	0	2395
1988	3726	2196	1484	24196	22219	205	57	0	0	0	0	302
1989	73	0	5303	3139	1212	0	0	0	0	0	0	0
1990	0	1085	2139	786	0	0	0	0	0	0	0	0
1991	0	198	2527	18360	7006	292	0	0	0	0	2705	138
1992	510	3907	18002	17349	1893	0	0	0	0	0	0	24
1993	36	360	360	5364	11724	1020	0	0	0	12	492	1134
1994	256	2796	1668	4293	888	36	0	0	0	12	0	2262
1995	3852	816	684	9390	24516	23820	1044	0	0	144	0	132
1996	864	1044	96	19068	15486	3072	14	0	0	24	192	72
1997	192	12	16296	19728	13260	3860	12	12	24	48	48	341

Figure 1: Sacramento-San Joaquin Delta Waterways



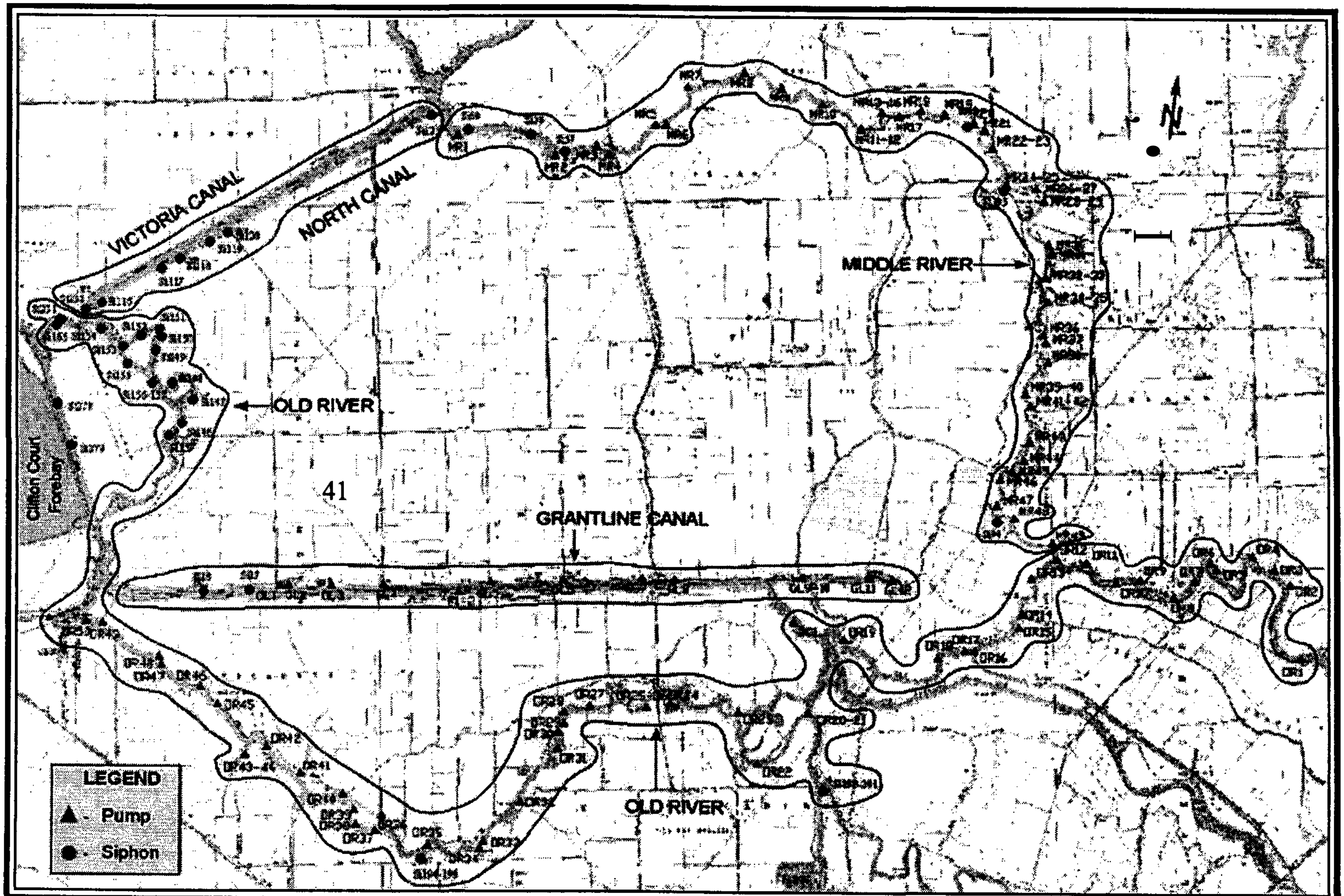
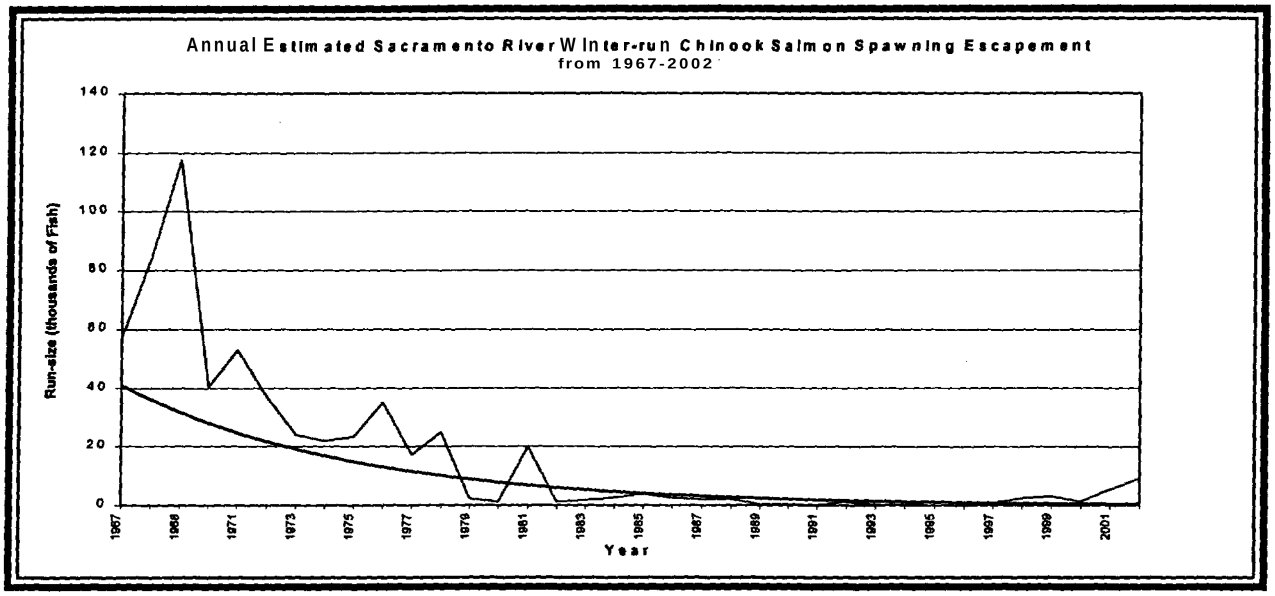


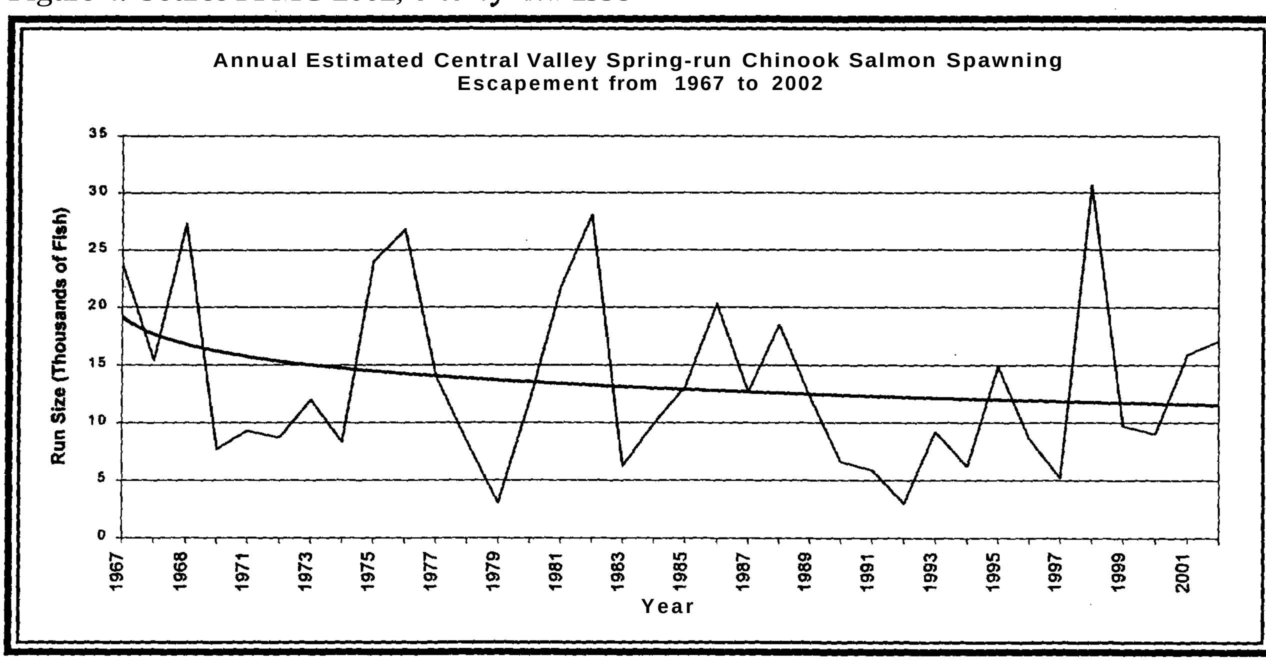
Figure 2: Action Area for DWR Project - South Delta

Figure 3: Sources NOAA Fisheries 1997, PFMC 2002



Trend line for Figure 3 is an exponential function: $Y = 46.606\, e^{-0.1269x}$ $R^2 = 0.5449$

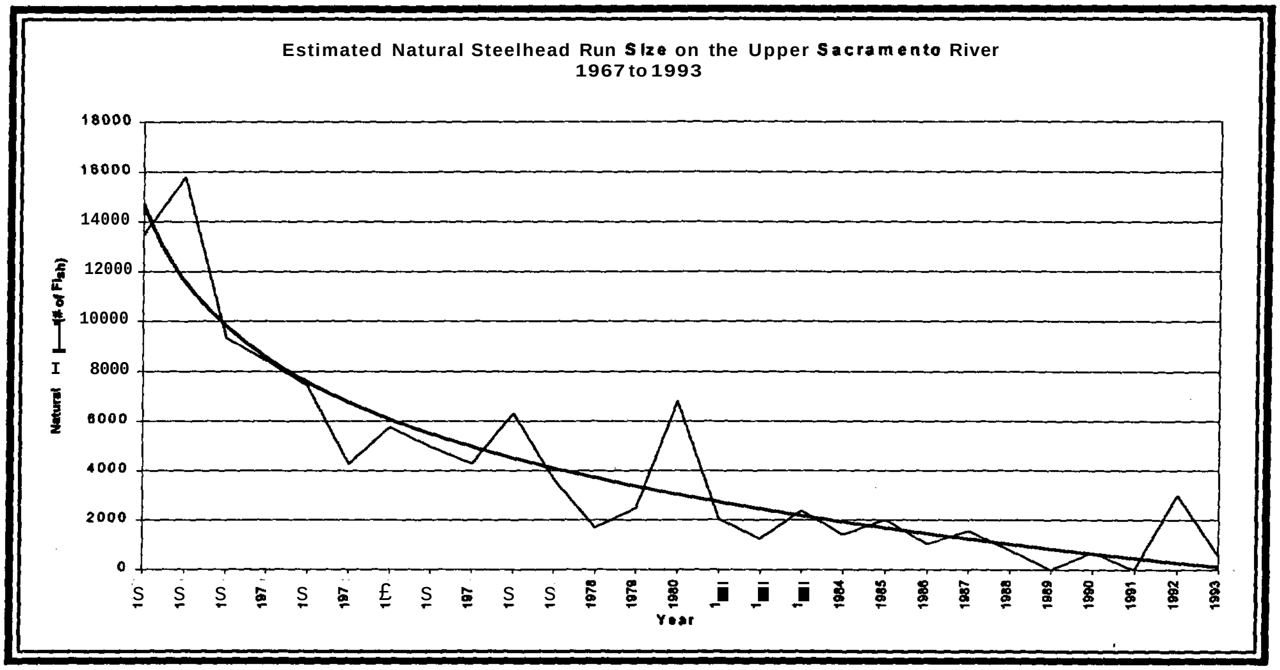
Figure 4: Source PFMC 2002, Yoshiyama 1998



Trend line for Figure 4 is an exponential function: $Y = -2.1276\, \mathrm{Ln}(x) + 19.146$, $R^2 = 0.0597$

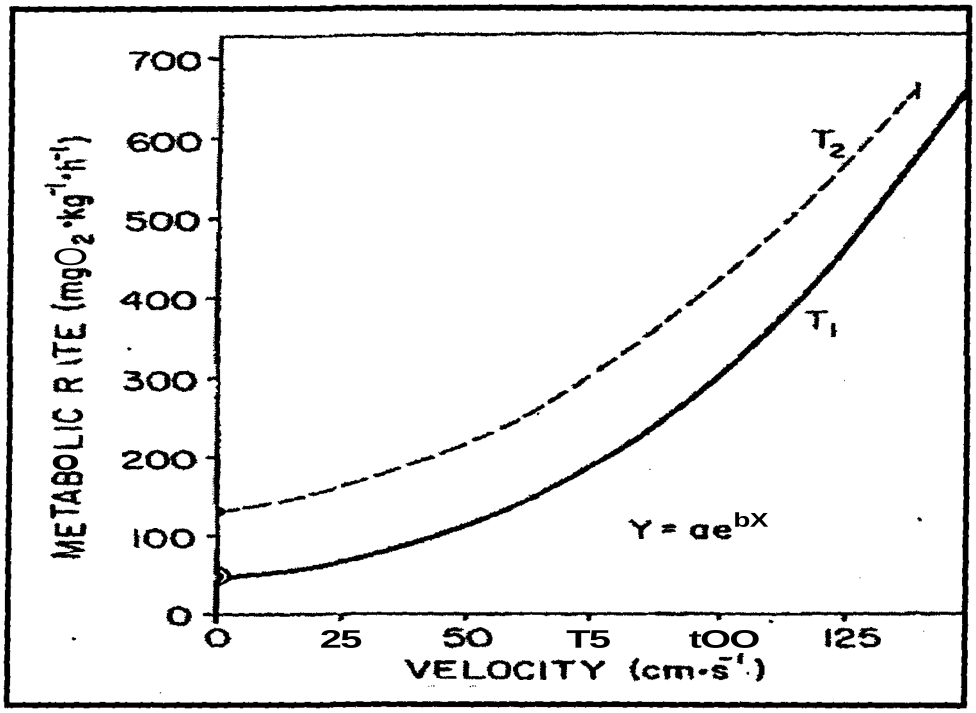
Mote: Steelhead escapement surveys at RBDD ended in 1993

Figure 5: McEwan and Jackson (1996)



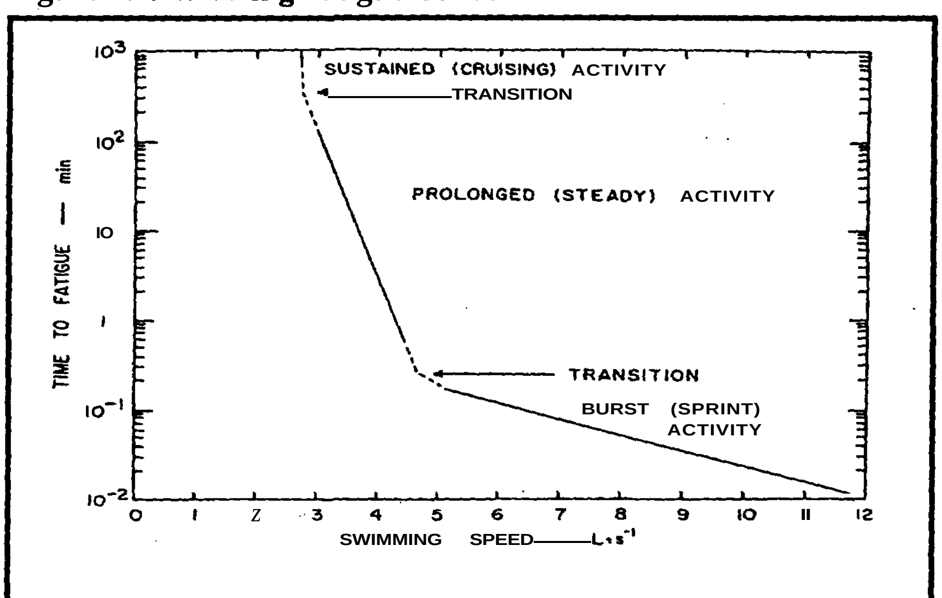
Trend line for Figure 5 is a logarithmic function: $Y = -4419 \ln(x) + 14690$ $R^2 = 0.8574$

Figure 6: Metabolic Oxygen Consumption V. Swimming Speed



General Relationship for the rate of metabolism at two temperatures T_1 and T_2, approximately 10° C different for changes in swimming velocity. (From Brett 1995)

Figure 7: Swimming Fatigue Curve

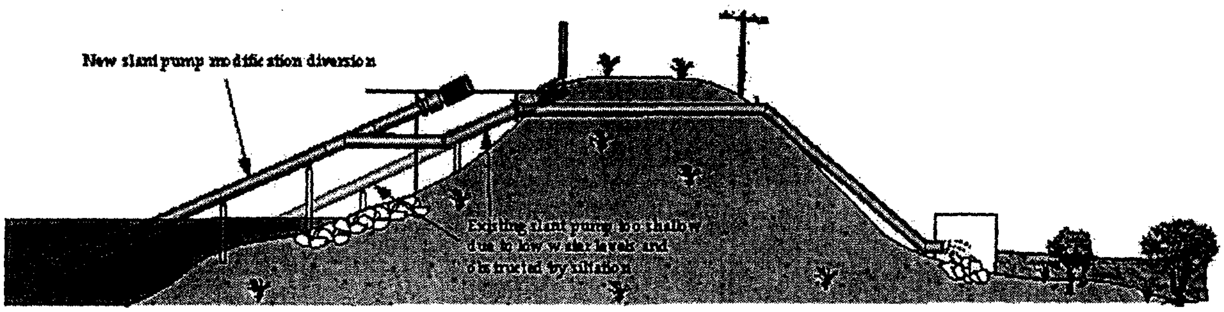


A fatigue curve for *sockeye* salmon illustrating the principal activity levels. (Adapted from Brett 1964, 1967)

Appendix 1:

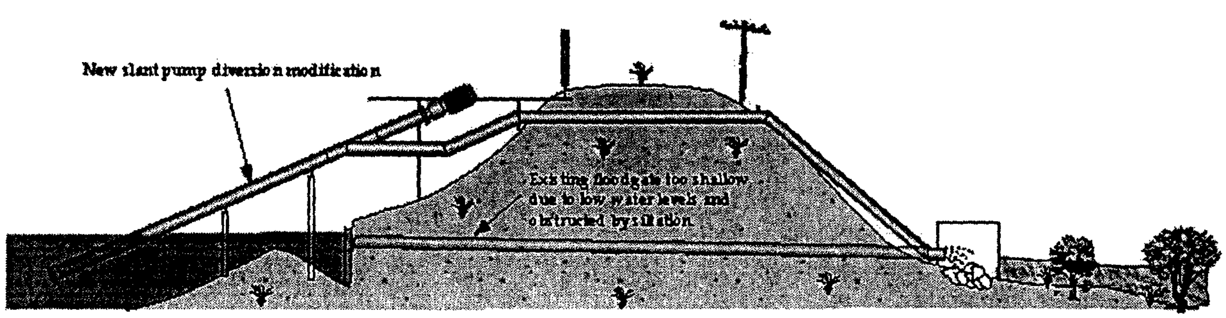
Typical Extended Slant Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



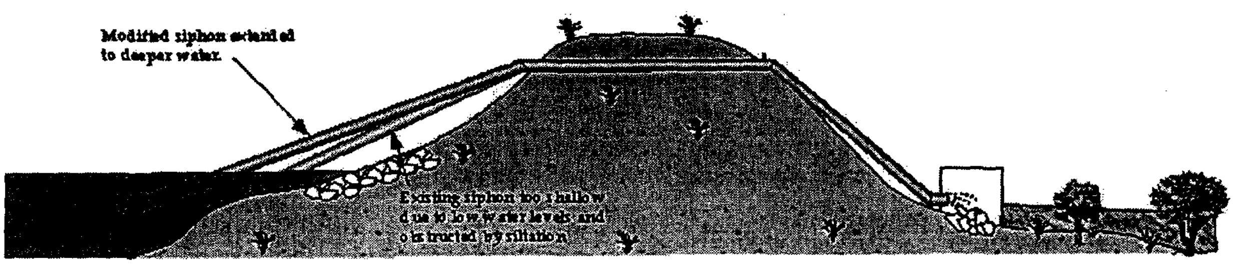
Typical Floodgate to Slant Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



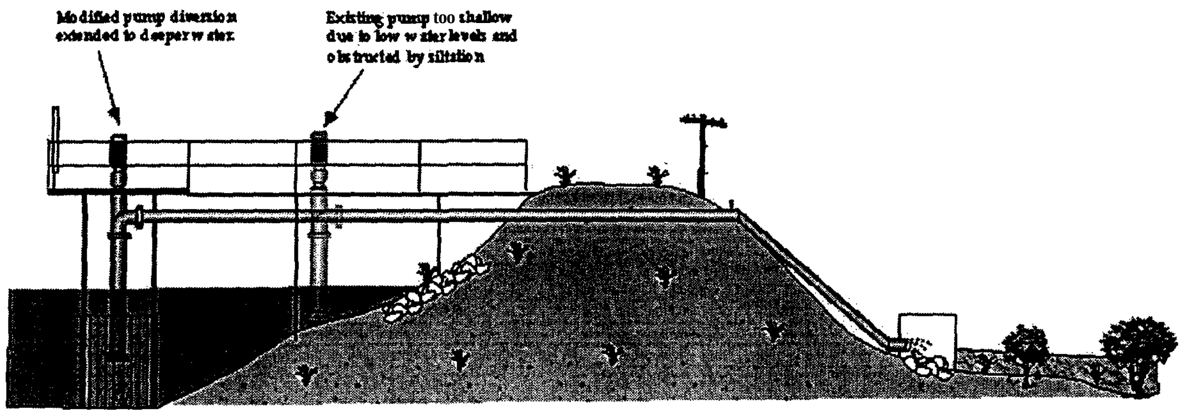
Typical Extended Siphon Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



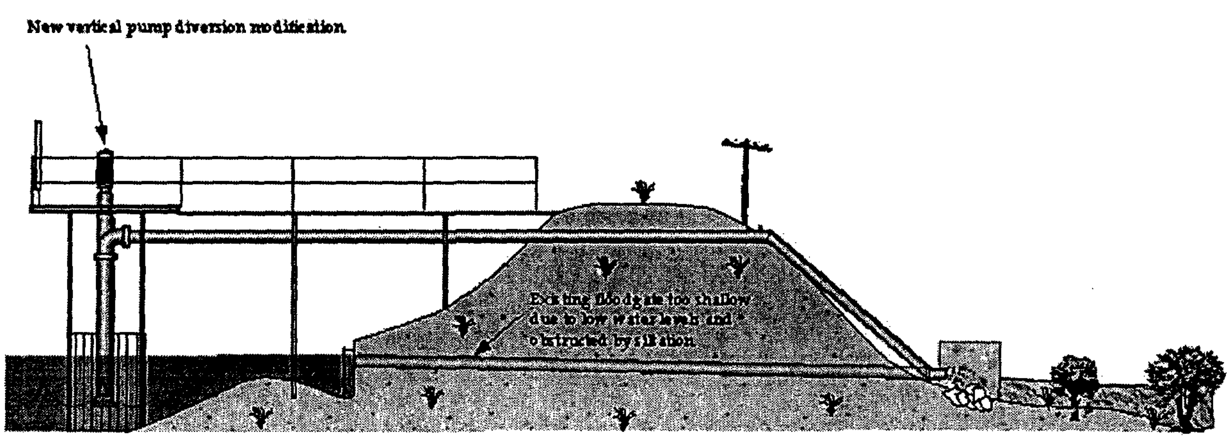
Typical Extended Vertical Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



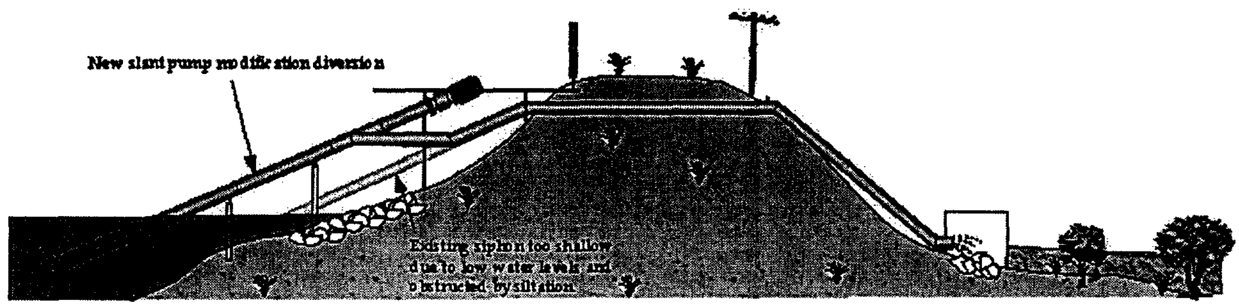
Typical Floodgate to Vertical Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



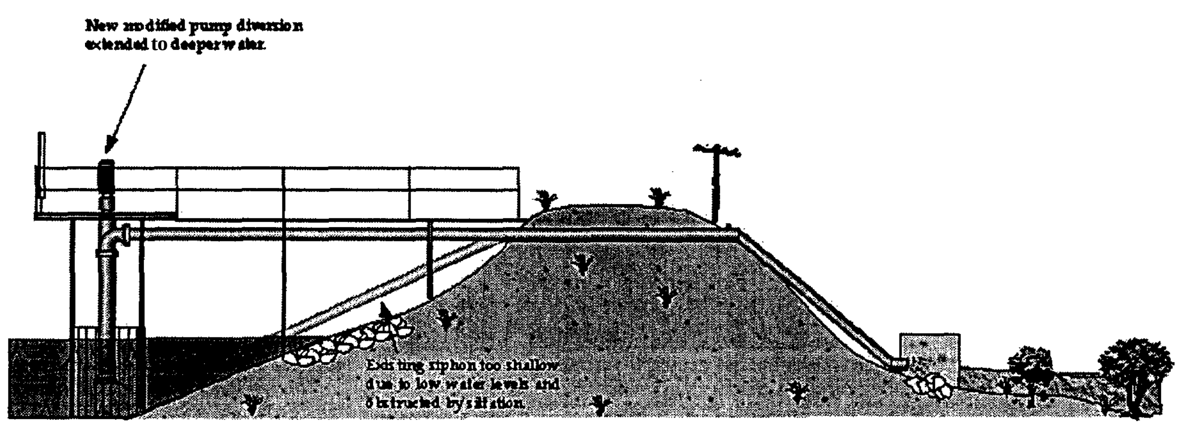
Typical Siphon to Slant Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



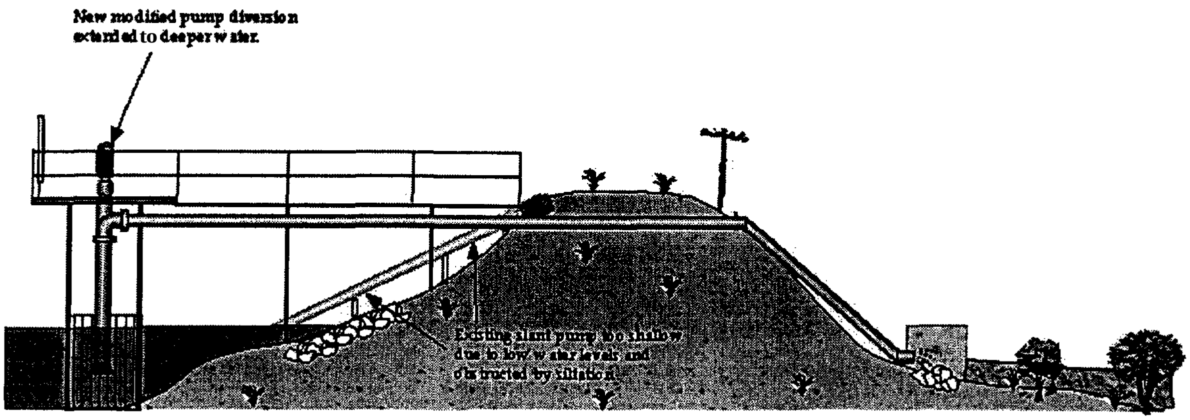
Typical Siphon to Vertical Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



Typical Slant Pump to Vertical Pump Diversion Modification

South Delta Regional Permit - Dredging/Diversion Modification



Appendix 2:

National Marine Fisheries Service
Southwest Region

JUVENILE FISH SCREEN CRITERIA FOR PUMP INTAKES

Developed by
National Marine Fisheries Service
Environmental & Technical Services Division
Portland, Oregon
May 9, 1996

ADDENDUM
JUVENILE FISH SCREEN CRITERIA FOR PUMP INTAKES

Developed by
National Marine Fisheries Service
Environmental & Technical Services Division
Portland, Oregon
May 9, 1996

The following criteria serve as an addendum to current National Marine Fisheries Service gravity intake juvenile fish screen criteria. These criteria apply to new pump intake screens and existing inadequate pump intake screens, as determined by fisheries agencies with project jurisdiction.

Definitions used in pump intake screen criteria

Pump intake screens are defined as screening devices attached directly to a pressurized diversion intake pipe.

Effective screen area is calculated by subtracting screen area occluded by structural members from the total screen area.

Screen mesh opening is the narrowest opening in screen mesh.

Approach velocity is the calculated velocity component perpendicular to the screen face.

Sweeping velocity is the flow velocity component parallel to the screen face with the pump turned off.

Active pump intake screens are equipped with a cleaning system with proven cleaning capability, and are cleaned as frequently as necessary to keep the screens clean.

Passive pump intake screens have no cleaning system and should only be used when the debris load is expected to be low, and

1) if a small screen (less than 1 CFS pump) is over-sized to eliminate debris impingement, and
2) where sufficient sweeping velocity exists to eliminate debris build-up on the screen surface, and
3) if the maximum diverted flow is less than .01% of the total minimum streamflow, or
4) the intake is deep in a reservoir, away from the shoreline.

Pump Intake Screen Flow Criteria

The **minimum effective screen area** in square feet for an **active** pump intake screen is calculated by dividing the maximum flow rate in cubic feet per second (CFS) by an approach velocity of 0.4 **feet per second (FPS). The minimum effective screen area** in square feet for a **passive** pump intake screen is calculated by dividing the maximum flow rate in CFS by an approach velocity of 0.2 FPS. Certain site conditions may allow for a waiver of the 0.2 FPS approach velocity criteria and allow a passive screen to be installed using 0.4 FPS as design criteria. These cases will be considered on a site-by-site basis by the fisheries agencies.

If fry-sized salmonids (i.e. less than 60 millimeter fork length) are not ever present at the site and larger juvenile salmonids are present (as determined by agency biologists), approach velocity shall not exceed 0.8 FPS for active pump intake screens, or 0.4 FPS for passive pump intake screens. The allowable flow should be distributed to achieve uniform approach velocity (plus or minus **10%)** over the entire screen area. Additional screen area or flow baffling may be required to account for designs with non-uniform approach velocity.

Pump Intake Screen Mesh Material

Screen mesh openings shall not exceed 3/32 **inch** (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (1.75 **ram)** for profile wire screens, with a minimum 27% **open area.** If fry-sized salmonids are never present at the site (by determination of agency biologists) screen mesh openings shall not exceed **1/4 inch** (6.35 mm) for woven wire, perforated plate screens, or profile wire screens, with a minimum of 40% **open area.**

Screen mesh material and support structure shall work in tandem to be sufficiently durable to withstand the rigors of the installation site. No gaps greater than 3/32 inch shall exist in any type screen mesh or at points of mesh attachment. Special mesh materials that inhibit aquatic growth may be required at some sites.

Pump Intake Screen Location

When possible, pump intake screens shall be placed in locations with **sufficient sweeping velocity** to sweep away debris removed from the screen face. Pump intake screens **shall be submerged** to a depth of at least one screen radius below the minimum water surface, with a minimum of one screen radius clearance between screen surfaces and adjacent natural or constructed features. A **clear escape route** should exist for fish that approach the intake volitionally or otherwise. For example, if a pump intake is located off of the river (such as in an intake lagoon), a conventional open channel screen should be considered, placed in the channel or at the edge of the river. Intakes in reservoirs should be as deep as practical, to reduce the numbers of juvenile salmonids that approach the intake. Adverse alterations to riverine habitat shall be minimized.

Pump Intake Screen Protection

Pump intake screens **shall be protected** from heavy debris, icing and other conditions that may compromise screen integrity. Protection can be provided by using log booms, trash racks or mechanisms for removing the intake from the river during adverse conditions. An **inspection and maintenance plan** for the pump intake screen is required, to ensure that the screen is operating as designed per these criteria.

Appendix 3:

WATER DRAFTING SPECIFICATIONS

National Marine Fish Service
Southwest Region

August 2001

"Water-drafting" is a short-duration, small-pump operation that withdraws water from streams or impoundments to fill conventional tank trucks or trailers. Usually, this water is used to control road dust, or for wildfire management.[1] Short term water drafting is also used to temporarily de-water a construction site, or to temporarily divert water around a construction site.

The specifications below are given primarily for the protection of juvenile anadromous salmonids, in waters where they are known to exist; but they also may be applied to protect a host of other aquatic organisms as well. The issue of sufficient in-stream flow for life support of the aquatic ecosystem should be addressed by a local Fish & Game biologist. Temporal and cumulative effects should be considered on a watershed scale. While we give some guidelines in that area, the actual impact of water drafting on stream ecology should be assessed and monitored at the local level by qualified personnel.

The main focus of this guidance is the construction, operation, and maintenance of a fish screen module(s) that must be installed at the in-stream end of the drafting hose to protect small salmon and steelhead fry from being entrained in the hose, or impinged on the surface of the screen. The specifications are based on the critical "approach velocity" at the screen surface[2], and a recognition that many temporary screens will not be outfitted with automatic cleaning devices to remove debris buildup. Since it is difficult to measure water velocities in the field, only the construction, pumping capacities, and operations are specified. Variances from these specifications may be considered on a case-by-case basis.

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1 In case of emergency wildfire, where human life is in danger, the operator may disregard the screening requirement if a suitable screen is not immediately accessible.

2 Approach velocity is the horizontal velocity vector component, typically measured at a distance of 3 inches from the screen face.

3 Restricting operations to daylight-only prevents the use of lights that will attract fish to the drafting pool

4 Restricting drafting to ten percent of the stream flow provides adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Ten percent of flow may be estimated by pump operators.

5 If larger pumping volumes are needed, or if the pumping application is continuous, refer to http://swr.nmfs.noaa.gov/habitat.htm and review addendum for small pump intakes.

Operating Guidelines

1. Operations are restricted to one hour after sunrise to one hour before **sunset.**[3]
2. Pumping rate shall not exceed 350 gallons per minute.
3. The pumping rate shall not exceed ten percent of the stream flow.[4]
4. Seek streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
5. Pumping shall be terminated when the tank is full. The effect of single pumping operations, or multiple pumping operations at the same location, shall not result in obvious draw-down of either upstream or downstream pools.
6. Each pumping operation shall use a fish screen. The screen face should be oriented parallel to flow for best screening performance. The screen shall be designed and used such that it can be submerged with at least one-screen-height-clearance above and below the screen.
7. Operators shall keep a log on the truck containing the following information: ***Operator's*** *Name, Date, Time, Pump Rate, Filling Time, Screen Cleaned (Y or N), Screen Condition, Comments.* These guidelines should be included as instructions in a logbook with serially numbered pages. This assures each truck operator easy access to this information.

Screen Construction Criteria

1. Surface Area

The total (unobstructed) surface area of the screen shall be at least 2.5 square feet, based on the upper limit of pumping of 350 gpm5. Larger surface areas are recommended where debris buildup is anticipated, and where stream depth is adequate to keep the screen submerged at approximately mid-depth.

2. Screen Mesh

Screen Mesh must be in good repair and present a sealed, positive barrier- effectively preventing entry of the "design fish" into the intake. The design fish in this case is a immature **(20-30mm)** salmon or steelhead fry.

The screen mesh size shall be: Round openings - maximum 3/32 inch diameter (.09 inch)
Square openings - maximum 3/32 inch diagonal (.09 inch)
Slotted openings - maximum 1/16 inch width (.07 inch)

3. Screen Design

Water drafting screens may be off-the-shelf products, but they are often custom-made devices appropriate to the scale and duration of pumping operation. To keep the screen supported and correctly positioned in the water column, adjustable support legs are advised. Screen geometry can be configured either as rectangular or cylindrical, i.e.- as a shallow "box-shape" or tubular. The intake structure shall be designed to promote uniform velocity distribution at all external mesh surfaces. This can be accomplished with a simple internal baffle device that distributes the flow evenly across the entire surface of the screen. In order to accomplish this, the designer needs to understand the hydraulic characteristics of these devices. There is a tendency for most of the intake water to enter the screen near the hose end, so a typical internal baffle would consist of a pipe (or a manifolded set of pipes) which have variable porosity holes at predetermined spacing. We recommend starting near the hose end with approximately **5-10%** average open area, and gradually increasing the porosity toward the length of the screen. At a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly. At this point the baffle porosity may approach **100%.** A successful baffle system will functionally distribute flow to all areas of the screen. A poorly designed screen may result in **high-velocity** "hot spots," which could lead to fish impingement on the screen face. Hydraulic testing of prototype screen designs is recommended where the application is on-going and extensive.

4. Screen Structure
The screen frame must be strong enough to withstand the hydraulic forces it will experience. However, structural frames, braces, and other elements that block the flow, change flow direction, or otherwise decrease the screen surface area should be minimized.

5. Screen Cleaning
The screen shall be cleaned as often as necessary to prevent approach velocity from exceeding 0.33 feet per second. Operators should withdraw the screen and clean it after each use, or as necessary to keep screen face free of debris. Pumping should stop for screen cleaning when approximately fifteen percent or more of the screen area is occluded by debris. A suitable brush shall be on board the truck for this cleaning operation.

If the operator notes (a) impingement of any juvenile fish on the screen face or **(b)** entrainment of any fish through the screen mesh, he/she should stop operations and notify the Department of Fish & Game **and/or NMFS** hydraulic engineering **staff** :

National Marine Fisheries Service
Engineering Section
777 Sonoma Avenue, Suite 325
Santa Rosa, CA. 95404
(707) 575-6050

Appendix 4:

MEMORANDUM OF AGREEMENT
REGARDING FISH SCREENS

PARTIES: The parties to this agreement are the "State" (California Department of Water Resources) and said "Diverter" (Landowner and Tenant) listed below.

State

Department of Water Resources
1416 Ninth Street
Sacramento, CA 95814

Diverter

Landowner:

Tenant:

Hereinafter the Landowner and Tenant are collectively referred to as Diverter.

RECITALS:

The undersigned landowner and tenant are referred to herein as the Diverter on the property designated on the attached map. Said property is currently irrigated with water from the Sacramento-San Joaquin Delta at the point designated on the attached map. Due in part to lowered water levels which result from the installation and operation of the temporary Grant Line Canal tidal barrier in its present location, Diverter's present diversion facility is no longer sufficient to provide an adequate supply of water for irrigation. Diverter and DWR seek to remedy this situation by modifying or replacing the existing diversion. CALFED and/or its member agencies seek to conduct an evaluation of the modified diversion's effects on various Delta fishery species and may seek to screen this and other similarly situated diversions.

This agreement is intended to bind the Diverter and State of California.

AGREEMENT:

1. CALFED and/or its member agencies may develop and conduct a fish sampling program which is designed to examine the effects of operating local agricultural diversions to endangered or threatened fish species in the south Delta, the need for screening in the south Delta, and the cost effectiveness of installing fish screens on diversions located in the south Delta. Such sampling program would include the development and evaluation of data, prioritization of screening needs, and peer review.

2. The Diverter agrees to participate in good faith with CALFED and/or its member agencies to develop the sampling program described in Paragraph 1. above, agrees to allow reasonable access as necessary to conduct such program, and agrees to allow the Diversion to be screened if such program in fact determines the need for screening.

3. The specific terms and conditions of any such program and the potential resulting screening shall be jointly developed by the Diverter, South Delta Water Agency, and CALFED and/or its member agencies. Those parties have previously developed an outline of conditions under which both sampling and screening could occur but have not yet agreed on how they might satisfy all parties' concerns. If the parties are unable to resolve all issues, they will consider things such as alternative dispute resolution in order to reach final agreement.

4. The purpose of this agreement is to satisfy certain provisions contained in the Diverter's Streambed Alteration Permit and Nationwide Permit Number 3 which require the Diverter to allow access to the Diversion for a fish sampling program and to allow the Diversion to be screened if CALFED deems it necessary. Execution of this agreement by the signatories satisfies these provisions.

SIGNED BY:

Diverter:

Landowner:

Dated:________________ ____________________________

Tenant:

Dated:________________ ____________________________

State:

Department of Water Resources

Dated:________________________By:__________________________

Enclosure 2

Manuson-Stevens Fishery Conservation and Management Act (MSA)

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.C. 180 *et seq.)*, requires that Essential Fish Habitat (EFH) be identified and described in Federal fishery management plans (FMPs). Federal action agencies must consult with the National Marine Fisheries Service (NOAA Fisheries) on any activity which they fund, permit, or carry out that may adversely affect EFH. NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to the Federal action agencies.

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary' means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon Plan (Salmon Plan) (PFMC 1999). Freshwater EFH for Pacific salmon in the Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers *et al.* (1998), and includes the San Joaquin Delta hydrologic unit *(i.e.*, number 18040003) which covers the project action area in the southern Sacramento-San Joaquin Delta (South Delta). Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha)*, Central Valley spring-run Chinook salmon *(O. tshawytscha)*, and Central Valley fall-/late fall-run Chinook salmon *(O. tshawytscha)* are species managed under the Salmon Plan that occur in the South Delta.

Factors limiting salmon populations in the South Delta include periodic reversed flows due to high water exports *(i.e.*, drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversion, predation by introduced species, and reduction in the quality and quantity of rearing habitat due to channelization, pollution, rip-rapping *etc.* (Kondolf *et al.* 1996a, 1996b; Dettman *et al.* 1987; California Advisory Committee on Salmon and Steelhead Trout 1988).

Life History And Habitat Requirements

General life history information for Central Valley Chinook salmon is summarized below. Information on Sacramento River winter-run and Central Valley spring-run Chinook salmon life histories is summarized in the preceding biological opinion for the proposed project (Enclosure 1). Further detailed information on Chinook salmon Evolutionarily Significant Units (ESUs) are available in the NOAA Fisheries status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.* 1998), and the NOAA Fisheries proposed rule for listing several ESUs of Chinook salmon (63 FR 11482).

Adult Central Valley fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from July through April and spawn from October through December (U.S. Fish and Wildlife Service 1998). Chinook salmon spawning generally occurs in clean loose gravel in swift, relatively shallow riffles or along the edges of fast runs (NOAA Fisheries 1997).

Egg incubation occurs from October through March (Reynolds *et al.* 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson *et al.* 1982). The remainder of fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, aquatic and riparian vegetation, logs, and undercut banks provide habitat for food organisms, shade, and protect juveniles and smolts from predation. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean. Whether entering the Delta or estuary as fry or juvenile, Central valley Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean.

II. PROPOSED ACTION

The proposed action is described in Part II *Description of the Proposed Action* of the preceding biological opinion for endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, Central Valley steelhead and critical habitat for winter-run Chinook salmon (Enclosure 1).

III. EFFECTS OF THE PROJECT ACTION

The effects of the proposed action on Sacramento River winter-run and Central Valley spring-run Chinook salmon habitat are described at length in Section V *(Effects of the Action)* of the preceding biological opinion, and generally are expected to apply to Central Valley fall-run

Chinook salmon habitat. However, because a larger proportion of fall-run Chinook salmon outmigration is expected to occur during April and May as compared to the other runs *(i.e.,* the peak for salvaged fish at the State and Federal pumping facilities), a higher percentage of salmonids in the South Delta during the start up of the irrigation season will be fall-run Chinook salmon. In addition, the overwhelming proportion of emigrating salmonids from the San Joaquin system are fall-run Chinook salmon, which must pass through portions of the South Delta to reach the ocean. Fish that emigrate before or after the April 15 to May 15 Vernalis Adaptive Management Plan (VAMP) flows will have direct access to the interior of the South Delta via the Old River channel (the Head of Old River Barrier is removed after the VAMP pulse Flows). Fish that enter the interior of the South Delta are subjected to an increased number of agricultural diversions, poorer water quality, increased transit times, and the effects of the State and Federal water projects.

IV. CONCLUSION

Based on the best available information, NOAA Fisheries believes that the proposed South Delta Diversions Dredging and Modification project may adversely affect EFH primarily for Central Valley fall-/late fall-run Chinook salmon, but also for Sacramento River winter-run Chinook salmon, and Central Valley spring-run Chinook salmon managed under the Salmon Plan.

V. EFH CONSERVATION RECOMMENDATIONS

The habitat requirements for Central Valley fall-/late fall-run Chinook salmon within the action area are similar to those of the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead addressed in the preceding biological opinion (Enclosure 1). Therefore, NOAA Fisheries recommends that terms and conditions 1b-c and 2a-e from the biological opinion (Enclosure 1) be adopted as EFH Conservation Recommendations for EFH in the action area. In addition, certain other conservation measures need to be implemented in the project area, as addressed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999; see below).

Conservation Measures for Agriculture. The restoration of the natural vegetative communities and functions should be a goal of riparian restoration and management projects on agricultural lands. Conservation practices and management plans should include water quality and the attainment of applicable Federal and State water quality standards. The following measures are recommended:

- Maintain riparian management zones of appropriate width on all waterways that include or influence EFH.

- Reduce sedimentation and runoff into South Delta waterways.

- Minimize the use of chemical treatments within the riparian management zone.

- Apply conservation measures for water usage to agricultural activities.

Bank Stabilization. The installation of riprap or other streambank stabilization devices can reduce or eliminate the development of side channels, functioning riparian and floodplain areas and off channel sloughs. The following measures are recommended:

- Use vegetative methods of bank erosion control whenever feasible. Hard bank protection should be a last resort when all other options have been explored and deemed unacceptable.

- Determine the cumulative effects of existing and proposed bio-engineered or bank hardening projects on salmon EFH, including prey species before planning new bank stabilization projects.

- Develop plans that minimize alterations or disturbance of the bank and existing riparian vegetation.

Irrigation Water Withdrawal, Storage and Management. In general, potential effects of freshwater system irrigation withdrawals on salmonid EFH include physical diversion and injury to salmonids, as well as impediments to migration, changes in sediment and large woody debris transport and storage, altered flow and temperature regimes, and water level fluctuations. Returned irrigation water to delta channels can substantially alter and degrade the habitat. General problems associated with return flows of surface water from irrigation practices include increased water temperature, salinity, pathogens, decreased DO, increased toxicant concentrations from pesticides and fertilizers, and increased sedimentation. The following measures are recommended:

- Identify and use appropriate water conservation measures in accordance with Federal and State laws.

- Monitor water quality in agricultural return drains and reduce sources of contaminants that negatively impact water quality through the application of appropriate management plans.

VI. STATUTORY REQUIREMENTS

Section 305(b)4(B) of the MSA requires the Corps to provide NOAA Fisheries with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by the Corps for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920[j]). In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreement with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

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